CalRecycle

California Department of
Resources Recycling and Recovery

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Contractor's Report

Cost Study on Commercial Recycling

Produced Under Contract by:

HF&H Consultants

CASCADIA CONSULTING GROUP

California Natural Resources Agency

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Executive Summary

This “Cost Study on Commercial Recycling” was conducted to understand the costs, savings, and net costs associated with the expansion of commercial recycling in California in response to the Mandatory Commercial Recycling Measure of the AB 32 Scoping Plan (hereinafter referred to as the “measure” or “proposed regulation”).

The objectives of this project were to develop two tools for use by CalRecycle and ARB in their development and implementation of the proposed regulation:

1. A model to estimate the costs, cost savings, and resulting net costs resulting from recovering a specified volume of different recyclable commodities; and,
2. A calculator tool to assist businesses in determining the cost, climate, and recycling benefits associated with their specific recycling programs.

This report documents the process used to develop these tools and the results of that process.

Summary of Findings

Annual Cost Estimates at Full Implementation of the Proposed Regulation in 2020

The total statewide net cost increase to the waste management and recycling system resulting from this regulation is estimated to range from $139 million (Scenario 2 – Traditional Recyclables and C&D) to $258 million (Scenario 3 – Traditional Recyclables and Organics) at full implementation of the proposed regulation in 2020. Figure ES-1, below, presents the net cost increase of the proposed regulation relative to the baseline scenario. The forecast of the long-term cost of the proposed regulation is presented in Figure ES-3 and detailed in Section 6.

Figure ES-1. Estimated Cost of the Proposed Regulation in 2020

	2020	% Increase Over Baseline
Estimated System Costs		
Annual Baseline Costs	$ 2,597,179,737	
Increase Over Baseline Costs		
Scenario 1	$ 162,965,833	6%
Scenario 2	$ 138,844,295	5%
Scenario 3	$ 257,587,906	10%
Scenario 4	$ 202,341,695	8%

Note: The dollar values are presented in 2008 dollars.

Each of the four scenarios (described in detail in Section 4) assumes in 2020 the management of the 27,882,502 tons of disposed commercial and multi-family material. The difference between the scenarios is the mix of tons recovered and how many tons of a specific material type are required to achieve the target reductions. In the cases of scenarios 3 and 4, significant additional tonnage is required to be recovered to achieve the target reductions, due primarily to the relatively lower emissions reduction factor associated with composting organic material.

Cost-effectiveness of recycling systems is typically measured as the cost per diverted ton. However, the objective of this measure is the reduction of greenhouse gas (GHG) emissions. As such, Figure ES-2 below demonstrates the cost per ton diverted as well as the cost per metric ton of carbon dioxide equivalents (MTCO2E), based on each scenario achieving the targeted 5MMTCO2E reduction.

Figure ES-2. Estimated Cost-Effectiveness of the Proposed Regulation at Full Implementation in 2020

	ESTIMATED COST EFFECTIVENESS			
	Estimated Net Costs Increase	**Assumed Tons Diverted**	**Cost per Diverted Ton**	**Cost per MTCO2E**
Scenario 1 (All Regions) – Traditional Recyclables	$162,965,833	1,478,078	$ 110.26	$ 32.59
Scenario 2 (All Regions) – Traditional Recyclables, C&D	$138,844,295	1,683,922	$ 82.45	$ 27.77
Scenario 3 (All Regions) – Traditional Recyclables, Organics	$257,587,906	3,427,062	$ 75.16	$ 51.52
Scenario 4 (All Regions) – Traditional Recyclables, C&D, Organics	$202,341,695	3,484,307	$ 58.07	$ 40.47

The results of the economic study illustrate that, depending on the mix of programs used to comply with this regulation, the cost-effectiveness of this measure may range from $27.77 to $51.52 per MTCO2E or $58.07 to $110.26 per recovered ton.

System Wide Cost of Mandatory Commercial Recycling Regulation (2012 – 2020)

The tonnage estimates calculated for the base year (2008) were inflated, as detailed in section 6, using available economic projections to forecast the annual cost of the measure for each year from 2012 to 2020. The dollar values for the forecast period are all presented in 2008 dollars. Figure ES-3 below presents the summary of the results of the cost forecasting.

Figure ES-3. Summary of Forecasted Cost Increases by Scenario

Increases During Forecasted Period					
	2012	**2013**	**2014**	**2015**	**2016**
Estimated System Costs					
Annual Baseline Costs	$ 2,308,784,596	$ 2,345,010,180	$ 2,385,953,601	$ 2,409,174,653	$ 2,447,306,865
Increase Over Baseline Costs					
Scenario 1	$ (25,350,748)	$ (4,782,877)	$ 15,348,311	$ 37,598,733	$ 60,492,410
Scenario 2	$ (29,290,233)	$ (11,866,647)	$ 7,628,901	$ 26,899,016	$ 47,247,829
Scenario 3	$ (11,700,025)	$ 20,785,810	$ 52,871,148	$ 84,141,140	$ 118,396,761
Scenario 4	$ (18,067,006)	$ 8,070,107	$ 35,042,275	$ 60,626,333	$ 89,065,347
	2017	**2018**	**2019**	**2020**	**Total 2012-2020**
Estimated System Costs					
Annual Baseline Costs	$ 2,484,639,976	$ 2,522,227,594	$ 2,559,142,483	$ 2,597,179,737	$ 22,059,419,685
Increase Over Baseline Costs					
Scenario 1	$ 84,207,627	$ 109,599,656	$ 135,850,930	$ 162,965,833	$ 575,929,875
Scenario 2	$ 68,177,024	$ 91,469,646	$ 114,767,713	$ 138,844,295	$ 453,877,544
Scenario 3	$ 151,287,130	$ 186,181,902	$ 220,843,805	$ 257,587,906	$ 1,080,395,577
Scenario 4	$ 116,324,994	$ 144,232,691	$ 173,392,742	$ 202,341,695	$ 811,029,179

These results forecast that the total net cost of this measure from 2012 to 2020 would be between $454 million and $1,080 million or $18.30 to $43.56 per MTCO2E (based on a 24.8 MMTCO2E reduction during the period from 2012 to 2020). This represents a 2.06% to 4.90% forecasted increase in system-wide costs.

Summary of Conclusions

In general, the cost estimates and forecasting resulted in the following key conclusions:

1. The proposed regulation may generate between 938 and 1,396 new full time equivalent recycling collection, support, supervisory, and management jobs.
2. Cost-effectiveness (measured in cost per recovered ton) is influenced primarily by the amount of material targeted for recovery. As more tons are recovered, the cost per recovered ton is reduced.
3. Cost-effectiveness is influenced by collection densities. As a result, the cost of programs in rural regions (where there are fewer businesses and those businesses are distributed over a larger area) may be several times greater on a per-ton basis.
4. Avoided disposal cost represents a significant cost savings (approximately$ 65 million to $153 million) as tonnage recovered increases.

5. Program scenarios that recover heavier and more efficiently-collected C&D are the most cost-effective.

6. Program scenarios that recover organic materials are, generally, the least cost-effective. This is, in part, a result of the relatively low (0.42) Compost Emissions Reduction Factor (CERF) associated with organic materials and the resultant need to recover significantly larger quantities of that material to achieve the target reductions. Another contributing factor is that commercial sector organic materials programs are relatively less common throughout the State. The lack of existing programs resulted in lower collection productivity assumptions for this study. The primary exception to this is in the Northern California A (Urban) region, where a significant number of the communities, including most of the large cities, have implemented commercial organics programs.

7. It should be noted that the results presented in this report do not reflect the various local pricing strategies used by service providers and/or local government to create incentives for recycling. Where local pricing strategies provide discounts or free service for recycling individual businesses may realize significant savings by maximizing their participating in a recycling program and reducing their garbage service.

Section 1. Introduction

Background

In 2006, California passed landmark legislation establishing the first economy wide climate change regulation in the United States. This California Global Warming Solutions Act of 2006 (Assembly Bill 32, Statutes 2006, Chapter 488) or “AB 32” establishes a goal of reducing GHG emissions in California to 1990 levels by 2020, an 11% reduction, on the way to a targeted 80% reduction by 2050. AB 32 establishes the Air Resources Board (ARB) as the lead regulatory agency for first developing a plan to achieve the target reductions and then adopting the necessary regulations to implement that plan.

In December 2008, the ARB adopted the AB 32 Scoping Plan, including a detailed list of the strategies that will be employed to achieve the target reductions. Among dozens of regulatory strategies, the scoping plan identified a number of solid waste management strategies including landfill methane capture, organics recovery alternatives (e.g., anaerobic digestion), mandatory commercial recycling, and product stewardship that will be critical elements in achieving the overall reductions. The Department of Resource Recovery and Recycling (CalRecycle) – formerly known as the California Integrated Waste Management Board – was designated as the lead agency for developing and implementing these solid waste management strategies.

The Mandatory Commercial Recycling Measure is intended to achieve reductions of 5MMTCO2E by 2020. As described in detail in Section 4, this will require the recovery of between 1.48 million and 3.49 million of the current 27.58 million tons from commercial sources. This estimate is based on tonnage and waste characterization data from CalRecycle and emissions reduction factor data from ARB.

The draft regulatory language for the Mandatory Commercial Recycling Measure would require any commercial or multi-family generator of over four cubic yards of material per week to participate in a recycling program.

Purpose of Study

The purpose of this study is to develop estimates and forecasts of the total cost associated with the proposed regulation. The California Government Code (Section 11346.3) requires State agencies to assess the potential for adverse economic impacts on businesses and individuals when proposing to adopt or amend any administrative regulation. The findings of this study will provide regulators with information on the cost-effectiveness of this measure as well as information on reasonable exemptions (e.g., generation thresholds, rural generators, material types, etc.). It will also provide CalRecycle, local government, and industry with information on the estimated and forecasted costs and savings associated with developing or expanding commercial recycling programs.

In addition to developing cost estimates and forecasts for purposes of satisfying the regulatory requirements, this study has developed a tool intended to help businesses understand the cost, diversion, and emissions benefits resulting from implementing or expanding source reduction and recovery in their operations.

Project Team

In November of 2008, CalRecycle selected HF&H Consultants, LLC (HF&H) through a competitive “Request for Proposals” process to perform the study. The consultant team also included subcontractors Cascadia Consulting Group, Inc. and Stanfield Systems, Inc. The consultant team was selected, in part, on the basis of the substantial experience and industry data that the individual members brought to the project. The consultant team joined the existing “Mandatory Commercial Recycling” team comprised of CalRecycle and ARB staff to form the project team.

HF&H Consultants, LLC

Since 1989, HF&H has specialized in planning, contracting for, and regulating the costs of municipal recycling, composting, and solid waste programs in California. During the more than 20 year history of the company, HF&H has been involved in more than 1,500 solid waste industry projects for more than 300 communities in California. This history provides the project team with cost and program data from hundreds of relevant projects performed for dozens of communities throughout the State ranging from the Humboldt Waste Management Authority to the City of San Diego.

Cascadia Consulting Group, Inc.

Founded in 1993, Cascadia Consulting Group (Cascadia) is a leader in designing, implementing, and evaluating solid waste management programs aimed at the commercial sector. For more than 15 years, Cascadia worked successfully with CIWMB on half a dozen major projects, including three statewide waste characterization studies, recycling rate studies, and recycling and waste characterization research for targeted industries. In addition, Cascadia has developed tools, similar to the one developed for this project, for communities and organizations in other areas of the country.

Stanfield Systems, Inc.

Stanfield Systems, Inc. has been meeting the needs of government, commercial, and non-profit organizations in California and across the United States since January 2000. Specializing in software development, comprehensive information technology project solutions, and providing technical resources in support of projects, Stanfield provided support to the project team during the data gathering and calculator testing phases of the project.

Project Approach Overview

This project was organized into four major phases – project initiation, data gathering, modeling, and reporting. Each of the first three phases is summarized briefly below. The data gathering and modeling phases are described more completely in the following sections.

Project Initiation

The preliminary phase of the project focused on working closely with CalRecycle staff to align the draft work plan to the project objectives and deliverables by meeting with the team, engaging a technical advisory committee, finalizing the work plan, and agreeing on the design requirements and format of the deliverables.

Data Gathering

A project of this type is dependent upon and limited by the representativeness and reliability of the data that underlies the analysis and calculations. In response to that dependency, the project team developed a two-fold data gathering strategy of:

1. Stakeholder engagement and targeted data gathering;
2. Supplemented by the substantial existing data resources of the project team.

This strategy was developed because the project team acknowledged the substantial data resources held by stakeholders – primarily the companies engaged in collecting, processing, transporting, and marketing recyclable commodities in California – but also respected the proprietary nature of the data required for this study. Because of this proprietary data and CalRecycle's history of difficulty in gathering this data from the industry for similar projects, the project team knew that data resources held by the consultant team would be necessary to supplement and validate any information gathered from industry.

Modeling

Once all of the data were gathered, the project team developed comprehensive spreadsheets and calculations to estimate and forecast the costs and cost savings. The details of this estimation and forecasting are described in Sections 4 through 7. The objectives of this process were to:

- Estimate the tons of each material type available in the commercial waste stream;
- Calculate the number of tons of each material type that would need to be recovered to achieve the target 5MMTCO2E reductions (based on disposal tonnage from CalRecycle and emissions reduction factors provided by ARB);
- Estimate the cost (in 2008 dollars) of recycling under a mix of different programmatic scenarios that might be used by communities to implement the proposed regulation;
- Forecast the 2012 to 2020 annual and cumulative cost (in 2008 dollars) of the proposed regulation; and,
- Develop a tool to demonstrate the cost, diversion, and GHG benefits resulting from individual businesses' implementation or enhancement of recycling programs.

Limitations

Inherent in any project or analysis are certain limitations. The more significant limitations are summarized below.

- **Statewide Scope and Regional Aggregation** – One of the primary objectives of this study was to estimate the statewide costs and savings resulting from Mandatory Commercial Recycling. This was achieved by estimating the cost within seven regions of the State and adding those regional costs together to estimate the statewide cost. The regions used for the study are large and within each region, there is a diversity of local conditions that affect costs. As a result of aggregating the costs within each of these diverse regions, the costs presented on a regional or statewide basis may appear higher or lower than the actual costs experienced by an individual service provider. For example, while the cities of San Francisco and Sacramento are in the same region, their costs are significantly different. The cost estimates for that region are likely to be higher than an individual service provider's costs in Sacramento, but lower than the costs for a service provider in San Francisco.

- **Target Emissions Reductions –** The estimates resulting from this study are intended to achieve a specific target reduction of GHGs resulting from the recycling of a specific number of tons of material under each scenario. These target reductions are precise at 5MMTCO2E, however, operating a program under "real world" conditions is inherently imprecise (i.e., the industry will not stop recycling when the target reductions are achieved). As such, the estimates presented are likely to differ, perhaps significantly, from the actual costs resulting from the regulation.

- **Rational and Informed Actors** – The estimates assume that both customers and industry are rational, profit-motivated, and informed of their options. Businesses are likely to respond to the regulation by establishing or enhancing recycling programs in the most cost-effective way practical. One element of cost-effectiveness to the businesses would be to reduce the subscription levels for solid waste service in a comparable amount to the added recycling service. The modeling assumes this reduction in disposal activity and the reduction in demand on the solid waste infrastructure (collection and disposal).

- **Impact of Future Regulatory/Legislative Action** – The estimates do not assume the adoption of any pending or future regulation or legislation (other than the Mandatory Commercial Recycling Measure) that may impact the costs, savings, and net costs estimated in the model.

- **Impact of General Economic Conditions** – The assumptions made to forecast the costs, savings, and net costs calculated in the model were based on indices from available sources (i.e., the Bureau of Labor Statistics and the Legislative Analyst's Office Economic Forecast). Any differences in the economic climate, relative to the assumptions used, may result in differences from the estimates presented herein. For example, if the economy were to recover faster than projected in the Economic Forecast, the waste generated by the commercial sector would increase; therefore, the 5MMTCO2E target may be achieved by recovering a smaller percentage of the waste stream than was anticipated by the model. Contrarily, if economic conditions degrade further, fewer tons are likely to be available in the discard stream, resulting in a greater percentage of those materials needing to be recovered to achieve the target reduction. Changes in economic conditions may also affect the industry's ability to perform at the levels of cost efficiency assumed in these estimates.

- **Reliance on 3rd Party Data/Representations of Providers** – Much of the data provided for and used in this study was the result of our stakeholder engagement process (described in detail in Section 2). HF&H cannot express an opinion on the accuracy of the underlying data collected from private and public sector haulers, processors, composters, and material brokers as the data has not been verified or audited by HF&H.

- **Availability of Data** – The most significant limitation of this study was the availability of data. As described in Section 2, the estimates in this study are the result of data gathered from the industry, project team files and databases, and literature review. However, the availability of data was constrained by the willingness of the industry to participate and those constraints resulted in data gaps for certain regions and for certain processing strategies. Where data gaps existed, data for comparable regions or processing strategies were used.

- **Approximations, Estimates, and "Rules of Thumb"** – In some instances, the calculations relied on approximations, estimates, ranges, and industry "rules of thumb" that provide detail and information accurate enough to inform decisions regarding commercial recycling programs implemented by businesses, local governments, CalRecycle, and the waste management and recycling industries.

- **Cost of Current Recycling** – The estimated and forecasted costs were calculated based on the volume of solid waste currently known to be disposed from commercial and multi-family sources. The cost estimates and forecasts do not include the cost of current recycling programs that recover millions of tons per year from the disposal stream. The estimates specifically did not include these costs because the purpose of the study was to determine the additional costs associated with the proposed regulation.

- **Technology** – The estimates assumed common methods and technologies for collecting and processing materials discarded by businesses. The technologies assumed were limited, in part, by the availability of cost data for those technologies.

    - Specific technologies that were not included in this study due to lack of sufficient cost data include co-collection of solid waste and recyclables, mixed waste processing (or "Dirty MRFing"), and anaerobic digestion.

    - Other technologies were specifically excluded from the study due to uncertainty and lack of data regarding the emissions reductions associated therewith. Those include various technologies for converting waste material into energy or transportation fuels.

    - A final group of technologies was specifically excluded due to a concern that the technology was not appropriate to the regulated community. The primary example of that technology is the use of carts and automated side-loading trucks for collection. While this is a common collection strategy, it may not be appropriate for medium to large generators (over 4 cubic yards per week) and tends to understate the costs of collection.

    - In addition to these technologies that were specifically excluded, countless unique strategies and approaches to achieving diversion which are not specified here were omitted due to either the complexity of modeling each program nuance or the existence of the strategy was not known.

- **Emission Reduction Factors** – The emissions reduction factors used in this study are provided by ARB and are not the product of this scope of work. HF&H has not reviewed the science or analysis that underlies these factors and makes no representation or warranty regarding their validity. In addition, it should be noted that emissions reduction factors were not available or were determined to be either negligible or negative values for certain highly recyclable materials (e.g., concrete). While the inclusion of these materials would have improved the cost-effectiveness of the measure in terms of cost per ton diverted, they would have resulted in decreased cost-effectiveness in terms of the cost per MTCO2E.

Section 2. Stakeholder Engagement

Stakeholder engagement has been a critical factor in the development of both the cost assessment model and the calculator tool. The stakeholder engagement process was deliberate and consistent throughout the course of the data gathering, analysis, and data validation phases of the project. While industry participation in the data gathering phase was not as great as desired, it was significant in filling data gaps (e.g., third-party trucking costs, detailed general ledger from single-stream processor, rural region collection productivity, etc.) and providing information about the state of the industry (e.g., available capacity of existing processing facilities, flow of recyclable commodities to ports, etc.) that formed the basis for many of our assumptions.

Industry Stakeholders

During the implementation phase of the project, the project team established the importance of engaging the industry in the process of data gathering. At that time, the team also acknowledged the historical difficulties in getting cost information from the industry due to the proprietary nature of that data.

In order to secure the greatest possible level of participation, the project team developed and contacted a list of approximately 50 high-ranking industry representatives from throughout the State. These contacts included both private and public sector service providers representing both large and small operations. The service providers included haulers, recycling processors, composters, landfill owner/operators, and recyclable material commodity brokers.

Each of the parties contacted was provided with two survey forms. The first was a survey questionnaire (Appendix R) intended to help understand many of the programmatic, operational, and qualitative aspects of commercial recycling within the State. The second was a cost survey form (Appendix S) intended to gather the specific quantitative data needed to perform the estimates.

Of those 50 contacted, only 6 participated fully in the survey (providing completed copies of the questionnaire and cost survey form). Four additional parties were willing to provide responses to the questionnaire, but were not willing or able to submit cost information.

While this represents a relatively low response rate (20%), the project team was very pleased to receive data from several generous data providers in regions and for processing strategies where there was relatively little cost data in the project team's files and databases.

Due to the low response rate, the confidentiality agreements between the project team and data providers, and the potential risk associated with publicizing the key operating results of companies, this report cannot list the participants or describe how they participated. However, it should be noted that the largest industry participants in the State (Waste Management Inc., Republic Services, and California Refuse Recycling Council) generally refused to participate in the data gathering process. However, they acknowledged to HF&H and CalRecycle that HF&H had gathered detailed cost and operational information about their companies through rate reviews and competitive procurements for a number of years.

Technical Advisory Committee

CalRecycle established a Technical Advisory Committee for the purposes of guiding this and other projects in support of the proposed regulation. That Technical Advisory Committee was instrumental in reviewing and providing direction on the detailed project work plan as well as the survey questionnaires used in the project. The Technical Advisory Committee is comprised of:

- California Refuse Recycling Council
- Californians Against Waste
- Edgar & Associates, Inc.
- Institute for Local Government
- Institute of Scrap Recycling, Inc.
- City of Los Angeles
- Los Angeles County Public Works
- Los Angeles County Sanitation District
- Monterey Regional Waste Management District
- Newport International
- Regional Council of Rural Counties
- City of San Jose
- Talco Plastics
- Waste Management

Public Meetings and Workshops

In addition to the targeted outreach and data gathering, the project team was engaged in a series of public meetings and workshops on the issue of mandatory commercial recycling to understand the likely ways in which local governments, service providers, and businesses would implement programs in reaction to the pending regulation. Additionally, these workshops were used to publicize the calculator tool and solicit feedback on key project inputs and results. These public meetings and workshops included:

- California Integrated Waste Management Board Mandatory Commercial Recycling Workshop in Sacramento on July 20, 2009
- California Resource Recovery Association Mandatory Commercial Recycling Conference Session in Rancho Mirage on August 3, 2009

- California Integrated Waste Management Board Mandatory Commercial Recycling Workshop in Diamond Bar on August 6, 2009
- Environmental Services Rural Counties Joint Powers Authority Meeting in Sacramento on October 15, 2009
- Alameda County Waste Management Authority Technical Advisory Committee Meeting in Oakland on April 16, 2010
- Contra Costa County AB 939 Manager's Meeting in Walnut Creek on May 4, 2010
- CalRecycle Mandatory Commercial Recycling Workshop in Sacramento on June 16, 2010
- Los Angeles County Integrated Task Force Meeting in Los Angeles on June 17, 2010

Calculator Tool Stakeholder Process

The stakeholder engagement process used for the calculator tool testing included many of the same participants as the cost study, including the technical advisory committee and the public meetings and workshops. The details of the industry and business engagement process for the calculator tool as well as the testing process are detailed in Section 7.

Section 3. Methods of Commercial Recycling in California

In order to estimate the cost of recovering a specified volume of recyclable commodities, it is critical to first understand the operational and programmatic approaches that will be used to do so. In order for material to be recovered, generally it must be separated by the generator, collected from the generator, delivered to a processing facility, sorted and prepared for market, and then sold to a market that is willing to pay for that material. Major exceptions to this are self-haul recycling programs that businesses operate where the collection and processing activities may be handled by the business. The discussion below describes each of these elements in the system as they are currently used in California to recover material from commercial sources.

Collection

California businesses discard well in excess of the approximately 27 million tons of material that are determined to enter landfills from commercial sources each year. Each and every ton of the material that a business discards must be removed from the business in some manner.

Conventional Collection Arrangements

In the urban regions of the State, as well as in most of the developed areas of the rural regions of the State, it is most common for a business to subscribe to some collection program offered by their city, town, county, or private hauler to manage their regular discards. Through these collection programs, the business is provided with some container (e.g., carts, bins, drop-boxes, compactors, etc.) into which the business discards their materials. The type and size of container used is typically agreed-upon by the business and the service provider and is based on the needs of the customer with consideration for issues like waste generation, available space, and the number of locations where discard containers are needed.

For the purposes of this study, businesses who subscribe to collection service were assumed to use bins, drop-boxes, and compactors, but not carts. The proposed regulation targets customers generating four or more cubic yards of waste each week. In order for these customers to recover fifty percent of their waste stream, they would require four or more recycling carts (assuming approximately 96-gallons of capacity each). HF&H acknowledges that carts are commonly used in commercial recycling programs to accommodate customers with space constraints or communities with relatively few businesses. If a business is space constrained, having four large recycling carts would require more space, overall, than a two-cubic yard bin with approximately the same capacity. Additionally, costs for commercial cart systems were not readily available because these costs are commonly included with the cost of residential recycling. HF&H reviewed this assumption with CalRecycle and it was determined that carts would not be separately accounted for in the study.

HF&H conducted a survey of data acquired from projects it performed for jurisdictions during 2008 to better understand the impact of the four cubic yard per week threshold. This survey provided a sample of 16,244 commercial accounts in 24 jurisdictions (Central Contra Costa Solid Waste Authority - CCCSWA represents six and South Bayside Waste Management Authority – SBWMA represents twelve) representing 4,903,158 cubic yards per year of service. From this limited sample, it is estimated that while approximately 48% of businesses would be exempt under the regulation, those businesses represent only 16% of the service volume. The results of that survey effort are summarized in the table below. It is important to note that the data collected is primarily concentrated in the Bay Area, which may or may not be representative of the State as a whole.

Figure 3-1. Sample Customer Distributions for 4 CY per Week Threshold

	Accounts			Service Volume (CY)		
Jurisdiction	**> 4 CY/Wk.**	**< 4 CY/Wk.**	**TOTAL**	**> 4 CY/Wk.**	**< 4 CY/Wk.**	**TOTAL**
Brentwood	68%	32%	336	88%	12%	105,456
CCCSWA	50%	50%	1,325	81%	19%	335,556
Livermore	45%	55%	1,256	81%	20%	344,656
Los Banos	42%	59%	364	92%	8%	79,300
Petaluma	78%	22%	731	86%	14%	260,078
San Jose	53%	47%	7,927	85%	16%	2,438,488
SBWMA	46%	54%	3,527	84%	16%	1,134,120
Union City	49%	51%	778	80%	20%	205,504
TOTAL	**52%**	**48%**	**16,244**	**84%**	**16%**	**4,903,158**

Note: Numbers may not sum precisely due to rounding.

Back-Hauling

In addition to the recovery activity that is facilitated by traditional collection service providers, many large businesses develop their own strategies for collecting, aggregating, and managing their own discards. This practice is common for big-box stores, grocery stores, and wholesalers who generate significant quantities of cardboard or food wastes and also have trucking fleets. These businesses will frequently make use of empty trucking capacity to “back-haul” their waste material to a central location. These businesses typically invest in pre-processing equipment (e.g., balers, shredders, grinders, etc.) and may even broker their own recyclable commodities.

Construction & Demolition

Unlike traditional recycling materials, C&D is collected almost exclusively in large containers (e.g., drop-boxes) or in large bodied trucks (e.g., end-dumps). This is the case because the material being collected is bulky by nature and tends to be generated in large quantities at a time. This type of activity only requires collection service for the duration of the construction or demolition activity at the property. Of all of the materials considered by this study, C&D is the most cost-effective (on a per-ton basis) to collect because of its high density and the high level of efficiency resulting from drop-box collection.

Self-Haul

The final method of removing materials from commercial business is for the business owner or their employees to self-haul their discards to a processor or landfill. This practice is common in more remote areas of the State where it is not cost-effective to invest in collection infrastructure or where economies of scale in recoverable material collection are not achievable. Self-hauling is also commonly used by businesses that have a temporary need to remove additional or bulky materials from their property and want to avoid the cost of a service provider.

Processing

When collection programs are established for businesses, the service provider typically works with the business to provide the type of program that is appropriate to the business and fit to a processing strategy available to the service provider. Several common processing strategies are presented below.

Single-Stream Processing

Many businesses can benefit from the same type of single-stream recycling program as residents, where various types of recyclable commodities are comingled in a single container and sent to a materials recovery facility (MRF) for sorting. These single-stream MRFs vary in design and range from a single conveyor belt with people on either side to sort materials from each other to highly sophisticated and automated systems incorporating digital optical sorters, air classification systems, eddy current separators, and powerful electromagnets that reduce the need for manual sorting.

Source Separated Material Processing

Other businesses may generate a significant quantity of a single material type (e.g., cardboard, office paper, metals, pallets, etc.) which would justify providing a container to collect that specific material to the exclusion of other materials. These single-material collection programs are generally more cost-efficient than mixed programs because of the increased value of the material and the reduced cost of having to sort materials at a MRF. However, if there are not a sufficient number of customers participating in the single-material program, it may not be cost-effective to collect this material separate from the single-stream materials. These programs frequently require some minimal level of preprocessing before materials can go to market. That pre-processing may include activities like light sorting, grinding, or baling.

Mixed Waste Processing

Some communities throughout the State, and particularly in southern California, have invested in infrastructure to sort through solid waste to recover recyclables at a mixed waste processing facility. These mixed waste sorting facilities eliminate the need for the business to separate materials at their location and save space that would be occupied by a recycling container. While each of the other common processing strategies described here were included in the study, mixed waste processing was specifically excluded due to a lack of cost data on this processing strategy. Data was also not available regarding the flow of materials to these facilities as opposed to single-stream MRFs.

Mixed C&D Processing

A large number of processing facilities have been developed to target loads of mixed construction debris (i.e., all discarded materials are comingled in a single container) which are then sent through a series of manual and automated sorting processes to extract the valuable and recoverable resources. It is common for these facilities to recover 65% to 85% or more of the incoming waste stream. Typically, these facilities focus their efforts on recovery of heavy and bulky materials like wood, metal, concrete, asphalt, and large sheets of cardboard. These facilities are generally not focused on collecting traditional recyclables like office paper, bottles, and cans.

Organic Materials Processing

Organic materials (i.e., yard waste, food waste, and compostable paper) represented 6,213,004 tons per year or 23% of the commercially disposed waste stream in 2008. California has made significant progress in recent years to reduce the disposal of these organic materials in landfills and the primary strategy for processing these materials is composting. Composting is a biological process of controlling the decomposition of organic waste that results in a high quality soil product which can be used in farming and landscaping applications. The resulting compost product, when land applied, has the benefit of returning nutrients to the soil and reducing the need for water and chemical fertilizers. While composting is the most common form of Organic Materials processing currently, new technologies are emerging that reduce the emissions and/or generate energy from organics processing operations.

Markets

Once recoverable materials are collected from businesses and sorted or processed, they are delivered to market. The markets for each of the materials considered in this study are highly dynamic. A processor or material broker may have different outlets that they use from one facility to another and from month to month in reaction to changes in pricing.

Export Commodities

California's significant lack of domestic recycling infrastructure for some recyclable commodities and the State's import/export relationships result in Pacific Rim countries, and particularly China, being the primary destination for recyclable commodities generated in California. For the purposes of this study, it is assumed that paper, cardboard, metals, and plastics are exported to foreign recyclers. HF&H and CalRecycle are aware that a significant percentage (greater than 10%) of HDPE, PET, and steel that are currently recovered in California are processed in-state. However, data to support the volume of additional material which could be processed in-state is not available. To the extent that such in-state capacity could be utilized commodity values may be higher and/or transportation costs may be lower than assumed in this study.

These exported commodities generally have a higher value than the other materials considered in this study, making them more cost-efficient to export. For the purposes of the study, export commodities are assumed to flow from each region to the nearest major port (Oakland or Long Beach).

Glass

In contrast to other traditional recyclable materials which are exported, glass is recycled domestically with several regional glass processors throughout the State and in Mexican border towns (specifically, Mexicali). The study assumes that glass from each region will flow to the nearest domestic glass processing facility.

Organic Materials

Organic Materials are generally processed within the region that they are generated. The primary exception to this is the food waste from large supermarket chains or food processors that frequently travel to centralized distribution centers, aggregated with the material from multiple sites, and then delivered for composting. For the purposes of this study, all organics (including green waste) were assumed to be composted and not used as alternative daily cover, alternative intermediate cover, or any other “beneficial use” at a landfill site.

Wood Waste

Within California, the most significant of use wood waste is as biomass fuel in energy generation. The next most common use is for mulch products. While precise figures regarding the volume of wood waste that would flow to either market is not readily available, stakeholders participating in the study stated and the literature review validated that, the value of wood waste as mulch versus biomass fuel is relatively comparable. As such, the study assumed that wood waste would be sold to a market within the region that it was generated and would either be used for mulch or biomass fuel.

Impact of Additional Volumes

During the process of interviewing material processors and brokers, several parties indicated that they believe that recyclable commodities markets could absorb the volume of tonnage that would be added to these markets as a result of the proposed regulation. While none of the survey participants could predict the impact of this tonnage on pricing, most felt that the impact would be minimal and that the general economic conditions would represent a much more significant price driver. As a result of this uncertainty and the responses indicating that the impacts would be minimal, the study assumes that recyclable commodity pricing would be unaffected by the additional volume, but would be impacted by other economic factors (i.e., inflation).

The one exception to this is that processing capacity for organics and the demand for finished compost may be significantly less than the supply contemplated by this study.

Regulatory Structures

AB 939 enabled each local government throughout the State to determine the best way to regulate waste and recycling activities in their communities. As a result, there are a number of regulatory structures in existence throughout the State for managing the collection of commercial solid waste and recycling. In general, each local government has created some system for regulating the solid waste activity in the commercial sector.

Municipal Collection

In some cases, that regulatory structure takes the form of a municipal service provider. In these cases, public forces collect material from customers. This is more common in the residential sector than it is in the commercial sector. Where municipal collection occurs in the commercial sector, many communities have already implemented commercial recycling programs and could expand these programs in response to the proposed regulation.

Exclusive Franchise Arrangements

In many communities, and particularly in Northern California and the San Francisco Bay Area, it is common to issue an exclusive franchise (or local government authorized monopoly) to a service provider in exchange for guaranteeing performance standards, ensuring that recycling services are provided to businesses, and allowing the jurisdiction to regulate the maximum rates that are charged to customers. Under a franchise system, communities have either already developed or could readily establish a commercial recycling program through this regulatory structure.

Non-Exclusive and Permit Systems

In other communities, and particularly in Southern California, it is more common to allow a number of private service providers to operate but to regulate those private companies through the use of a non-exclusive franchise or permit system. Communities can use their permits or non-exclusive franchises to require service providers to offer recycling services to all businesses that request it. However, it may be relatively more difficult to develop comprehensive commercial recycling in one of these systems than in a municipal or exclusive system.

Incentive Pricing Strategies

A local government's selection of their regulatory structure can have a significant impact on the pricing of services to customers. In the more highly regulated areas of the State (i.e., where exclusive franchises and municipal collection are common) pricing subsidies exist between solid waste and recoverable materials services. This creates a price signal to customers that encourages reducing solid waste volume and recovering more of their waste. While this subsidy acts to encourage recycling, it may confuse the public and create a perception that "recycling is free". In fact, it is just as cost-intensive, if not more so, to send a recycling truck around to collect material as it is to send a garbage truck.

Public Education & Outreach

Public education and outreach are generally acknowledged as being fundamental to the success of any recycling program. As part of each local government's responsibilities under AB 939, a wide variety of public education and outreach programs have been developed for commercial recycling throughout the State. These programs range from low-effort strategies like bill inserts or newsletters to highly involved targeted outreach and technical assistance programs. While these public education and outreach elements are critical to the success of the commercial recycling systems that will be implemented in response to the Mandatory Commercial Recycling Measure, it was beyond the scope of this study to determine the cost of those programs to businesses, the recycling industry, or local governments.

Section 4. Tonnage Modeling

This section describes the detailed process used to develop the model of the commercial disposed waste stream within the State of California. The model was developed from Cascadia's waste characterization databases in order to identify the amount of key recoverable materials present in the commercial disposed waste stream in each of the seven regions that together comprise the entire State.

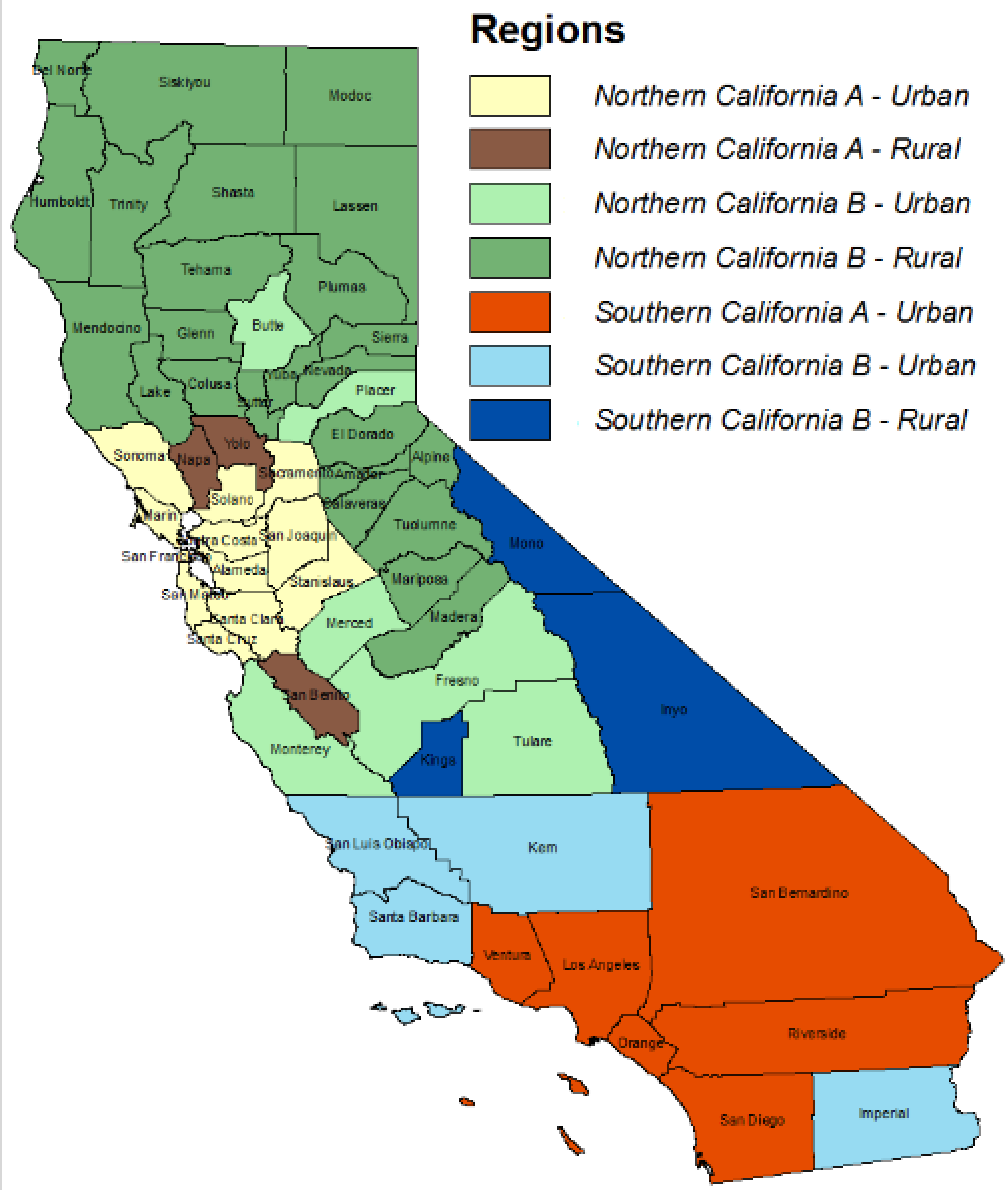
Definition of Regions

For the purpose of this study, the project team established four major geographic areas and seven analysis regions to discriminate between rural and urban areas. The regions are as follows, including the counties noted:

- Northern California A (Urban Counties): Marin, Sonoma, Solano, Sacramento, Contra Costa, Alameda, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, and Stanislaus
- Northern California A (Rural Counties): Napa, Yolo, and San Benito
- Northern California B (Urban Counties): Placer, Merced, Monterey, Butte, Fresno, and Tulare,
- Northern California B (Rural Counties): Alpine, Amador, Calaveras, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Madera, Mariposa, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Sutter, Tehama, Trinity, Tuolumne and Yuba
- Southern California A: Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura
- Southern California B (Urban Counties): Imperial, Kern, San Luis Obispo, and Santa Barbara
- Southern California B (Rural Counties): Inyo, Mono, and Kings.

Those counties landfilling less than 200,000 tons per year were categorized as rural to account for differences in costs within those geographic areas. This resulted in a total of seven reporting categories for the purposes of this study. None of the counties identified in the "Southern California A" geographic area were designated rural counties.

Figure 4-1. Diagram of Defined Regions



The following primary evaluation criteria were used to categorize counties into these regions:

- **Port Used to Export Commodities**. While glass, lumber, organics, and limited volumes of plastics and metals are processed domestically, export has historically been the primary market for the vast majority of recoverable material commodities in California. Measurement of this criterion is the one-way distance to the nearest port from the largest city within each county. Those counties that are closer to the Port of Oakland are included in the "Northern California" regions, while those that are closer to the Port of Los Angeles/Long Beach are included in the "Southern California" regions.

- **Access to Export Markets**. The cost of transporting materials to market is one of the most widely variable cost components in a recovery system. This is the case, primarily, because the largest single market for materials is accessed through the shipping ports located in Oakland, Los Angeles/Long Beach, and, to a lesser extent, San Diego. Recyclable commodities which are generated near those ports are most cost-effectively brought to market. Measurement of this criterion is the one-way distance to the nearest port from the largest city within each county. Counties within 90 miles of a port are included in the "A" regions while those counties that are more than 90 miles from the nearest port are assigned to a "B" region.

Modeling Methodology

The commercial disposed waste stream was categorized into four sub-sectors, which are listed below along with abbreviations that are used throughout this section:

- Commercially-generated waste, not from construction or demolition activities, that is collected by commercial haulers (COM-MSW), including multi-family waste since it is often collected with this sub-sector

- Commercially-generated waste, not from construction or demolition activities, that is self-hauled (COM-SH)

- Commercially-generated waste from construction and demolition activities that is collected by commercial haulers (COM-C&D)

- Commercially-generated waste from construction and demolition activities that is self-hauled (COM-SH-C&D)

The general approach in developing the model was first to estimate the quantity of waste associated with each subsector in each region of the State, and secondly to overlay on that quantity an estimated composition profile that included all of the identified materials. Thus, the model produced estimates of the tons of each material believed to be disposed in each region for each waste subsector.

Quantity Estimates

The total disposed tons for each county in 2008 were obtained from California's Disposal Reporting System. For the purpose of this model, tons disposed by each county included material that originated in each county and that was disposed somewhere in California, as well as figures for material that was exported for disposal in other states.

To apportion the disposed tons among the identified regions and waste subsectors, the calculations rely on data obtained during gatehouse surveys conducted at solid waste facilities during the 2008-09 statewide waste characterization study commissioned by CalRecycle. Drivers of vehicles bringing waste to selected facilities were asked to describe the origin of the waste according to the four commercial sub-sectors described above as well as waste originating from multi-family residences, and additional categories that lie outside the commercial waste stream. The classification and net weight of each surveyed waste load was noted.

To quantify the waste attributable to the four commercial waste subsectors, the model considers the three rural regions described above to be combined in a single "overall rural" region of the state. This was done because there were not enough facilities or survey data points to quantify the waste subsectors individually for each of the three rural regions.

Each solid waste facility where surveying took place during the 2008-09 CalRecycle study was assigned to one of the identified urban regions or to the combined "overall rural" region. Then, based on a weighted averaging of survey responses at facilities within each region, estimates of the fraction of all disposed solid waste that was associated with each of the four commercial subsectors (including multi-family) were calculated. These subsector fractions were then applied to the total disposed waste reported for the counties belonging to each region. The subsector fractions that were calculated for the combined rural areas were applied separately to each group of counties in the three rural areas considered in the study.

Composition of COM-MSW

The estimated composition of COM-MSW for each region was based on the makeup of the commercial sector in each region - the numbers and size (measured by employment) and types of businesses present. This study classified the commercial sector according to 36 types of business, institution, or government agency, hereinafter called "industry groups". The number of employees in each industry group was combined with a unique disposal composition profile and disposal quantity figure to produce estimates of the amount of each type of material disposed by each industry group in the region. Disposal composition and quantity profiles for specific industry groups were extracted from the following three waste characterization study reports:

- *Statewide Waste Characterization Study: Results and Final Report*, California Integrated Waste Management Board, 1999
- *Characterization of Municipal Solid Waste for the City of Los Angeles*, City of Los Angeles Bureau of Sanitation, Solid Resources Citywide Recycling Division, 2001
- *Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups*, California Integrated Waste Management Board, 2006

The material categories from the three reports were generally consistent, but included more or less detail regarding certain material types, many of which are not considered to be recovered under this study (e.g., various categories of special or hazardous wastes). The material categories were organized and combined to match the shorter list of materials that was required as output from the model.

The industry groups, which were originally defined based on the Standard Industrial Classification (SIC) system, were re-categorized according to the newer North American Industry Classification System (NAICS). Average employment figures for 2008, organized by county and NAICS designation, were then obtained from the State of California Employment Development Department's Quarterly Census of Employment and Wages.

Composition data from each industry group were aggregated to develop a composite estimate for each of the State's seven regions, reflecting the estimated tons of each material disposed by employees of each of 36 industry groups as well as total tons disposed by the COM-MSW sector. The initial projected total for each region was then reconciled with the quantity estimate for COM-MSW that was calculated earlier for each region. This step also adjusted material amounts estimated for each region, which were then totaled to estimate statewide amounts for each material type. As a final reconciliation step, the total amount of each targeted material estimated by the model was reconciled to match the statewide figure for COM-MSW that was derived from data in the most recent statewide characterization study, conducted by CalRecycle in 2008-09. It should be noted that this statewide figure, developed specifically for this study, does not exactly match data reported in the statewide study due to differences in the waste sectors and regions used in each study.

Composition of Other Subsectors

A composition profile for COM-C&D was calculated based on a weighted analysis of samples from multiple construction and demolition activity types examined as part of CalRecycle's *Targeted Statewide Waste Characterization Study: Detailed Characterization of Construction and Demolition Waste*, the report for which was published in 2006. The composition profile was consolidated to fit the materials identified for the waste model, and composition percentage estimates were applied to the estimated tons of COM-C&D disposed by each of the regions.

Composition profiles for COM-SH, COM-SH-C&D and multi-family subsectors were calculated based on a weighted analysis of sample data from CalRecycle's *California 2008 Statewide Waste Characterization Study*. The composition profiles were consolidated to fit the materials described in the waste model, and the composition percentage estimates were applied to the quantity estimates for the seven regions. The quantity estimates for the multi-family subsector were then added to those for the COM-MSW subsector to get the total amounts of materials included in that sector.

Tons Available by Region

The results of the tonnage calculations result in the following tonnages by material type being available within each of the seven regions. Figure 4-2 below summarizes the total tonnage available by region, while Figures 4-3, 4-4, 4-5, and 4-6 demonstrate the four major delivery types for that tonnage – Commercial Hauled Non-C&D, Commercial Hauled C&D, Commercial Self-Hauled Non-C&D, and Commercial Self-Hauled C&D.

Figure 4-2. Summary of Commercial Waste Disposal by Region and Material Type

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Material Type	**TOTAL ALL SECTORS**							
HDPE	27,299	1,272	9,019	3,947	84,462	4,883	516	131,398
PET	20,458	907	6,846	3,073	62,475	3,686	398	97,844
Other Plastics	291,021	14,734	100,912	45,002	959,225	58,265	6,275	1,475,433
Aluminum Cans & Nonferrous Metals	15,490	635	4,783	2,180	49,004	2,639	263	74,995
Steel Cans & Ferrous Metals	166,992	7,400	49,549	23,143	572,573	29,068	2,763	851,487
Glass Containers	51,414	2,550	18,377	8,644	147,840	10,304	1,178	240,306
Cardboard & Paper Bags	260,404	12,863	92,618	41,643	853,125	50,919	5,248	1,316,820
Magazines & Catalogs	31,184	1,389	10,015	4,376	93,188	5,481	558	146,190
Newsprint	54,900	2,367	16,970	8,045	163,685	9,876	962	256,806
Office Paper	110,873	5,085	36,821	15,632	339,441	19,833	1,955	529,640
Phone Books	3,277	194	1,289	494	9,609	586	79	15,528
Compostable Paper	328,399	15,879	116,368	51,424	1,028,885	63,302	6,887	1,611,144
Dimensional Lumber	316,951	14,629	92,767	49,758	1,161,694	50,188	4,806	1,690,793
Food	672,589	34,397	252,199	118,709	2,014,157	138,139	15,963	3,246,153
Yard Waste	327,518	12,098	80,850	38,919	973,133	56,838	4,352	1,493,708
Carpet	126,758	4,292	28,363	15,924	466,347	18,428	1,559	661,671
Concrete	107,517	2,770	19,529	8,944	368,803	10,906	1,040	519,509
Tires	6,745	291	2,578	1,183	23,616	1,439	91	35,944
All Other Materials	2,524,177	91,189	611,730	300,371	9,229,765	393,712	36,277	13,187,222
TOTAL	**5,443,965**	**224,943**	**1,551,584**	**741,410**	**18,601,026**	**928,493**	**91,169**	**27,582,590**

Figure 4-3. Commercial Hauled Non-C&D by Region and Material Type

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Material Type	**Commercial Hauled Non-C&D**							
HDPE	25,384	1,220	8,756	3,773	77,014	4,577	494	121,218
PET	19,745	888	6,749	3,008	59,497	3,577	390	93,854
Other Plastics	228,310	12,970	92,247	39,170	699,402	48,233	5,542	1,125,876
Aluminum Cans & Nonferrous Metals	11,991	579	4,388	1,995	36,397	2,346	240	57,937
Steel Cans & Ferrous Metals	107,550	6,028	41,960	18,610	339,736	21,449	2,193	537,527
Glass Containers	49,371	2,495	18,096	8,464	141,054	9,966	1,155	230,602
Cardboard & Paper Bags	227,236	11,998	88,218	38,781	704,042	46,317	4,888	1,121,479
Magazines & Catalogs	29,764	1,352	9,830	4,255	85,922	5,305	543	136,971
Newsprint	49,423	2,204	16,180	7,506	145,491	8,850	894	230,547
Office Paper	104,862	4,931	36,038	15,122	309,645	19,072	1,891	491,561
Phone Books	3,277	194	1,289	494	9,609	586	79	15,528
Compostable Paper	295,408	15,056	112,056	48,704	887,134	58,871	6,545	1,423,774
Dimensional Lumber	192,345	12,253	78,097	41,903	626,829	38,671	3,819	993,917
Food	651,386	33,749	249,111	116,566	1,941,503	134,086	15,693	3,142,095
Yard Waste	219,105	9,041	65,688	28,816	581,392	38,350	3,083	945,476
Carpet	74,861	2,911	21,400	11,357	239,450	10,913	985	361,877
Concrete	24,094	1,634	10,552	5,189	65,389	5,398	568	112,823
Tires	6,334	282	2,526	1,153	22,088	1,387	88	33,858
All Other Materials	1,257,389	61,350	449,633	201,737	3,933,080	233,373	23,880	6,160,442
TOTAL	**3,577,836**	**181,135**	**1,312,816**	**596,603**	**10,904,673**	**691,327**	**72,970**	**17,337,360**

Figure 4-4. Commercial Hauled C&D by Region and Material Type

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Material Type	**Commercial Hauled C&D**							
HDPE	168	1	16	4	558	4	1	753
PET	44	0	4	1	145	1	0	196
Other Plastics	1,905	14	180	45	6,326	50	6	8,525
Aluminum Cans & Nonferrous Metals	2,096	15	198	50	6,959	54	6	9,378
Steel Cans & Ferrous Metals	15,902	114	1,499	377	52,805	414	47	71,158
Glass Containers	377	3	36	9	1,252	10	1	1,687
Cardboard & Paper Bags	2,483	18	234	59	8,246	65	7	11,112
Magazines & Catalogs	32	0	3	1	106	1	0	143
Newsprint	303	2	29	7	1,007	8	1	1,358
Office Paper	248	2	23	6	822	6	1	1,108
Phone Books	0	0	0	0	0	0	0	0
Compostable Paper	4,811	34	454	114	15,974	125	14	21,526
Dimensional Lumber	48,796	350	4,600	1,156	162,032	1,269	145	218,348
Food	216	2	20	5	717	6	1	967
Yard Waste	9,583	69	903	227	31,821	249	29	42,881
Carpet	3,489	25	329	83	11,585	91	10	15,611
Concrete	57,916	415	5,460	1,372	192,314	1,506	172	259,155
Tires	131	1	12	3	434	3	0	584
All Other Materials	274,992	1,970	25,925	6,513	913,137	7,151	819	1,230,507
TOTAL	**423,490**	**3,034**	**39,925**	**10,030**	**1,406,243**	**11,012**	**1,261**	**1,894,996**

Figure 4-5. Commercial Self-Hauled Non-C&D by Region and Material Type

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Material Type	**Commercial Self-Hauled Non-C&D**							
HDPE	1,214	38	179	125	3,979	241	16	5,791
PET	377	12	56	39	1,235	75	5	1,797
Other Plastics	36,019	1,125	5,314	3,718	118,090	7,153	467	171,885
Aluminum Cans & Nonferrous Metals	924	29	136	95	3,030	184	12	4,410
Steel Cans & Ferrous Metals	26,470	827	3,905	2,732	86,783	5,257	343	126,317
Glass Containers	1,632	51	241	168	5,350	324	21	7,787
Cardboard & Paper Bags	12,265	383	1,809	1,266	40,210	2,436	159	58,528
Magazines & Catalogs	194	6	29	20	637	39	3	927
Newsprint	5,071	158	748	523	16,626	1,007	66	24,200
Office Paper	1,150	36	170	119	3,769	228	15	5,486
Phone Books	0	0	0	0	0	0	0	0
Compostable Paper	12,895	403	1,902	1,331	42,277	2,561	167	61,537
Dimensional Lumber	18,904	590	2,789	1,951	61,979	3,754	245	90,213
Food	19,553	611	2,885	2,018	64,107	3,883	254	93,311
Yard Waste	82,395	2,573	12,155	8,505	270,138	16,364	1,069	393,198
Carpet	22,493	702	3,318	2,322	73,744	4,467	292	107,337
Concrete	12,928	404	1,907	1,334	42,384	2,567	168	61,692
Tires	199	6	29	21	651	39	3	948
All Other Materials	473,574	14,788	69,862	48,881	1,552,649	94,052	6,143	2,259,949
TOTAL	**728,254**	**22,740**	**107,432**	**75,169**	**2,387,639**	**144,632**	**9,447**	**3,475,315**

Figure 4-6. Commercial Self-Hauled C&D by Region and Material Type

	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Material Type	**Commercial Self-Hauled C&D**							
HDPE	533	13	68	44	2,910	61	6	3,636
PET	293	7	37	24	1,598	33	3	1,996
Other plastics	24,787	626	3,172	2,068	135,406	2,829	260	169,147
Aluminum cans and nonferrous metals	479	12	61	40	2,618	55	5	3,270
Steel cans and ferrous metals	17,070	431	2,184	1,424	93,249	1,948	179	116,486
Glass containers	34	1	4	3	184	4	0	230
Cardboard and paper bags	18,421	465	2,357	1,537	100,626	2,102	193	125,701
Magazines and catalogs	1,194	30	153	100	6,523	136	13	8,149
Newsprint	103	3	13	9	561	12	1	701
Office paper	4,614	116	590	385	25,205	527	48	31,485
Phone books	0	0	0	0	0	0	0	0
Compostable paper	15,285	386	1,956	1,275	83,500	1,744	160	104,307
Dimensional lumber	56,905	1,436	7,281	4,748	310,854	6,494	597	388,315
Food	1,433	36	183	120	7,829	164	15	9,780
Yard waste	16,435	415	2,103	1,371	89,781	1,875	172	112,153
Carpet	25,916	654	3,316	2,162	141,569	2,957	272	176,847
Concrete	12,579	318	1,610	1,050	68,715	1,435	132	85,838
Tires	81	2	10	7	443	9	1	553
All other materials	518,223	13,081	66,311	43,240	2,830,899	59,137	5,434	3,536,324
TOTAL	**714,384**	**18,033**	**91,411**	**59,608**	**3,902,471**	**81,521**	**7,492**	**4,874,920**

Tons Required to Achieve Target Reductions

In 2008, California businesses disposed of approximately 27 million tons of material with approximately 14 million of those tons being identified as readily recoverable material types. While those material types are generally considered to be readily recoverable, they may not be easily captured by the programs that typically exist within the commercial sector. The most significant example of this is in programs targeting mixed C&D. The material delivered to these programs contains varying amounts of food waste, recyclable paper, bottles and cans, film plastic, and various other materials that would normally be considered readily recoverable. However, the volume of these materials relative to the wood waste, metals, and inerts (e.g., concrete, asphalt, etc.) is quite small. Because of the difficulty of capturing these small volumes of potentially recoverable materials, most facilities will allow them to pass through their process and be disposed of.

In order to understand the cost of recovering the additional material required to achieve the 5MMTCO2E reduction, one must first establish how those tons will be captured and managed. To do this, HF&H considered four likely programmatic scenarios, each of which is described in the following subsections. The recycling emissions reduction factors (RERF) and compost emissions reduction factors (CERF) used in this analysis were provided by the ARB and have not been independently verified or reviewed as part of this scope of work. HF&H assumes the ARB calculations to be informed and based on good science and quantitative analysis.

Scenario 1 – Traditional Recyclables

Under this "Traditional Recyclables" scenario, a total of 3,272,467 tons of the materials that might be captured in such a program are available statewide. Due to the relatively high RERFs associated with these material types, this scenario requires the fewest total tons (1,478,078) to achieve the target emissions reduction. However, it also requires the largest percentage (approximately 45.17%) of the available tons to be captured.

Figure 4-7. Scenario 1 Emissions Reduction Summary

Material Type	RERF/CERF	Available Tons (All Regions)	Annual CO2E Reduction Potential
HDPE	0.80	127,009	101,607
PET	1.40	95,651	133,912
Other Plastics	1.20	-	-
Aluminum Cans & Nonferrous Metals	12.90	62,347	804,276
Steel Cans & Ferrous Metals	1.50	663,844	995,766
Glass Containers	0.20	238,389	47,678
Cardboard & Paper Bags	5.00	1,180,007	5,900,034
Magazines & Catalogs	0.30	137,898	41,369
Newsprint	3.40	254,747	866,141
Office Paper	4.30	497,047	2,137,300
Phone Books	2.70	15,528	41,925
Compostable Paper	0.42	-	-
Dimensional Lumber	0.21	-	-
Food	0.42	-	-
Yard Waste	0.42	-	-
TOTAL		**3,272,467**	**11,070,008**
Target CO2E Reduction			5,000,000
% of Available Tons for 5MMTCO2E		1,478,078	45.17%

Scenario 2 – Traditional Recyclables and C&D

The second scenario is based on collecting and processing traditional recyclables (similar to scenario 1) and adding C&D recycling programs (e.g., C&D ordinances, Green Building Requirements, etc.). This scenario does not consider organic materials. Under such a scenario, source separated and/or comingled traditional recyclables are collected and processed. However, some traditional recyclables (HDPE, PET, glass containers, magazines, newsprint, and office paper) are assumed to be residue from material processed by C&D processing facilities because of the limited volume of that material in the delivered stream and the high level of effort to capture such volumes.

Under this "Traditional Recyclables and C&D" scenario, a total of 4,216,235 tons of the materials that might be captured in such a program are available statewide. This scenario requires 1,710,288 total tons to achieve the target emissions reduction. While this represents a small increase over Scenario 1, it requires a smaller percentage (approximately 40.56%) of the available tons to be captured.

Figure 4-8. Scenario 2 Emissions Reduction Summary

Material Type	RERF/CERF	Available Tons (All Regions)	Annual CO2E Reduction Potential
HDPE	0.80	127,009	101,607
PET	1.40	95,651	133,912
Other Plastics	1.20	-	-
Aluminum Cans & Nonferrous Metals	12.90	74,995	967,432
Steel Cans & Ferrous Metals	1.50	851,487	1,277,231
Glass Containers	0.20	238,389	47,678
Cardboard & Paper Bags	5.00	1,316,820	6,584,100
Magazines & Catalogs	0.30	137,898	41,369
Newsprint	3.40	254,747	866,141
Office Paper	4.30	497,047	2,137,300
Phone Books	2.70	15,528	41,925
Compostable Paper	0.42	-	-
Dimensional Lumber	0.21	606,664	127,399
Food	0.42	-	-
Yard Waste	0.42	-	-
TOTAL		**4,216,235**	**12,326,096**
Target CO2E Reduction			5,000,000
% of Available Tons for 5MMTCO2E		1,710,288	40.56%

Scenario 3 - Traditional Recyclables and Organics

The third scenario is based on collecting traditional recyclables (similar to scenario 1) and adding organic materials recovery programs. This scenario assumes that the organic materials would be collected (either by a hauler or delivered to a recycling facility by a self-hauler) separate from other waste material. This scenario does not consider materials delivered to landfills as C&D.

Under this "Traditional Recyclables and Organics" scenario, a total of 9,331,858 tons of the materials that might be captured in such a program are available statewide. Due to the relatively low emissions reduction factors associated with composting, this scenario requires the second most total tons to achieve the target emissions reduction. This tonnage requirement is more than twice that of Scenario 2, but requires nearly the same percentage (approximately 36.72%) of the available tons to be captured.

Figure 4-9. Scenario 3 Emissions Reduction Summary

Material Type	RERF/CERF	Available Tons (All Regions)	Annual CO2E Reduction Potential
HDPE	0.80	127,009	101,607
PET	1.40	95,651	133,912
Other Plastics	1.20	-	-
Aluminum Cans & Nonferrous Metals	12.90	62,347	804,276
Steel Cans & Ferrous Metals	1.50	663,844	995,766
Glass Containers	0.20	238,389	47,678
Cardboard & Paper Bags	5.00	1,180,007	5,900,034
Magazines & Catalogs	0.30	137,898	41,369
Newsprint	3.40	254,747	866,141
Office Paper	4.30	497,047	2,137,300
Phone Books	2.70	15,528	41,925
Compostable Paper	0.42	1,485,311	623,831
Dimensional Lumber	0.21	-	-
Food	0.42	3,235,406	1,358,871
Yard Waste	0.42	1,338,674	562,243
TOTAL		**9,331,858**	**13,614,952**
Target CO2E Reduction			5,000,000
% of Available Tons for 5MMTCO2E		3,427,062	36.72%

Scenario 4 – Traditional Recyclables, C&D, and Organics

The fourth scenario is based on developing programs for traditional recyclables (similar to scenario 1), C&D (similar to scenario 2), and organic materials (similar to scenario 3).

Under this scenario, a total of 10,430,661 tons of the materials that might be captured in such programs are available statewide. Due to the relatively low emissions reduction factors associated with composting, this scenario requires the most total tons (3,491,749) to achieve the target emissions reduction. This scenario results in the lowest required capture rate (33.48%).

Figure 4-10. Scenario 4 Emissions Reduction Summary

Material Type	RERF/CERF	Available Tons (All Regions)	Annual CO2E Reduction Potential
HDPE	0.80	127,009	101,607
PET	1.40	95,651	133,912
Other Plastics	1.20	-	-
Aluminum Cans & Nonferrous Metals	12.90	74,995	967,432
Steel Cans & Ferrous Metals	1.50	851,487	1,277,231
Glass Containers	0.20	238,389	47,678
Cardboard & Paper Bags	5.00	1,316,820	6,584,100
Magazines & Catalogs	0.30	137,898	41,369
Newsprint	3.40	254,747	866,141
Office Paper	4.30	497,047	2,137,300
Phone Books	2.70	15,528	41,925
Compostable Paper	0.42	1,485,311	623,831
Dimensional Lumber	0.21	606,664	127,399
Food	0.42	3,235,406	1,358,871
Yard Waste	0.42	1,493,708	627,357
TOTAL		**10,430,661**	**14,936,154**
Target CO2E Reduction			5,000,000
% of Available Tons for 5MMTCO2E		3,491,749	33.48%

Section 5. Cost Modeling

This section documents the estimates of net costs, presents the general assumptions used in the estimation process, and details the methodology employed to arrive at the results. Detailed tables documenting the results of the cost estimation are presented in Appendices A through E.

Summary of Modeling Results

The summary findings of the cost estimation are illustrated on a statewide and regional basis in the following figures. All estimates are presented in 2008 dollars. All specific cost and operating assumptions that underlie this analysis are presented in detail in the "inputs" portion of the model provided to CalRecycle. Section 6 describes the results of forecasting of these costs through 2020.

State of California

As illustrated in Figure 5-1 below, the results estimate that the statewide baseline commercial system costs (i.e., to collect and dispose of all 27 million tons) total approximately$ 2.54 billion annually and that the proposed regulation would result in an additional cost of $130 million (Scenario 2) to $252 million (Scenario 3) per year. This represents a statewide system cost increase of 5.1% to 9.9% for the base year (2008) estimates.

Figure 5-1. State of California Summary of Results

	State of California				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 1,343,197,612	$ 1,642,605,330	$ 1,622,210,509	$ 1,744,788,293	$1,691,760,037
Annual Processing Subtotal	$-	$ 113,817,041	$ 111,916,508	$ 151,349,931	$ 148,220,204
Annual Transportation Subtotal	$-	$ 21,960,657	$ 25,787,234	$ 38,417,975	$ 40,511,202
Annual Disposal Subtotal	$ 1,199,302,985	$ 1,134,578,939	$ 1,124,799,573	$ 1,049,197,855	$1,046,742,433
Annual Commodity Subtotal	$-	$ (213,595,417)	$ (212,168,790)	$ (189,242,463)	$ (189,657,090)
TOTAL Annual Cost/(Savings)	**$ 2,542,500,596**	**$ 2,699,366,550**	**$ 2,672,545,035**	**$ 2,794,511,592**	**$2,737,576,787**
Annual Cost Increase					
Collection Increase	$-	$ 299,407,718	$ 279,012,898	$ 401,590,682	$ 348,562,426
Processing Increase	$-	$ 113,817,041	$ 111,916,508	$ 151,349,931	$ 148,220,204
Transportation Increase	$-	$ 21,960,657	$ 25,787,234	$ 38,417,975	$ 40,511,202
Disposal Increase	$-	$ (64,724,046)	$ (74,503,411)	$ (150,105,130)	$ (152,560,552)
Commodity Increase	$-	$ (213,595,417)	$ (212,168,790)	$ (189,242,463)	$ (189,657,090)
TOTAL Increase	**$-**	**$ 156,865,954**	**$ 130,044,438**	**$ 252,010,996**	**$ 195,076,191**
Total Tons Managed	27,582,590	27,582,590	27,582,590	27,582,590	27,582,590
Total Tons Recovered	-	1,478,078	1,710,288	3,427,062	3,491,749
MTCO2E	-	5,000,000	5,000,000	5,000,000	5,000,000
Cost per Ton Managed	$ 92.18	$ 97.86	$ 96.89	$ 101.31	$ 99.25
Additional Cost per Ton Recovered	n/a	$ 106.13	$ 76.04	$ 73.54	$ 55.87
Additional Cost per MTCO2E	n/a	$ 31.37	$ 26.01	$ 50.40	$ 39.02

The "cost per ton managed" shown in Figures 5-1 through 5-8 equals the "total annual cost" divided by the "total tons managed". This measure depicts the total system-wide cost-effectiveness. The "additional cost per ton recovered" equals the "total increase" divided by the "total tons recovered". This measure depicts the cost-effectiveness of recovery operations under each scenario. The "additional cost per MTCO2E" equals the "total increase" divided by the 5MMTCO2E reduction target for this measure. This measure depicts the cost-effectiveness of the GHG reductions under each scenario.

Northern California A (Urban)

Figure 5-2 below illustrates the cost estimates for the Northern California A (Urban) region. The results in this region are unique among the regions in that the scenarios that include organics do not result in the significant system cost variances, relative to the other scenarios, that other regions do. This is, in part, because organics programs in the region, and particularly in the Bay Area where the majority of the region's tons are generated, are more substantially developed. Therefore, the modeling assumes that these programs have already begun to achieve economies of scale and collection productivity and the additional tons going into those programs as a result of this regulation will make the programs more cost-effective than they are currently.

In addition, this region is already achieving higher levels of traditional material recovery and the economies of scale that go along with that. As such, the modeling does not assume that the traditional recyclable materials collection productivity in this region will increase beyond current levels. While this assumption may not accurately reflect the entire region, it is representative of the vast majority of the large communities in the region, which are the predominant sources of the tons considered for the region.

The results estimate that the Northern California A (Urban) baseline commercial system costs (i.e., to collect and dispose of all 5.4 million tons) total approximately $531 million annually and that the proposed regulation would result in an additional cost of $35 million (Scenario 2) to $39 million (Scenario 3) per year. This represents a regional system cost increase of 6.6% to 7.5%.

Figure 5-2. Northern California A (Urban) Summary of Results

	Northern California A (Urban)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 294,837,914	$ 359,886,266	$ 356,630,636	$ 363,868,145	$ 359,023,073
Annual Processing Subtotal	$-	$ 26,553,763	$ 26,378,471	$ 34,119,686	$ 33,631,765
Annual Transportation Subtotal	$-	$ 4,728,671	$ 5,224,374	$ 7,875,152	$ 8,059,925
Annual Disposal Subtotal	$ 236,678,053	$ 223,366,485	$ 221,863,367	$ 205,406,357	$ 205,433,967
Annual Commodity Subtotal	$-	$ (44,332,063)	$ (43,439,140)	$ (39,808,148)	$ (39,347,843)
TOTAL Annual Cost/(Savings)	**$ 531,515,967**	**$ 570,203,121**	**$ 566,657,708**	**$ 571,461,191**	**$ 566,800,887**
Annual Cost Increase					
Collection Increase	$-	$ 65,048,352	$ 61,792,723	$ 69,030,231	$ 64,185,160
Processing Increase	$-	$ 26,553,763	$ 26,378,471	$ 34,119,686	$ 33,631,765
Transportation Increase	$-	$ 4,728,671	$ 5,224,374	$ 7,875,152	$ 8,059,925
Disposal Increase	$-	$ (13,311,568)	$ (14,814,686)	$ (31,271,696)	$ (31,244,086)
Commodity Increase	$-	$ (44,332,063)	$ (43,439,140)	$ (39,808,148)	$ (39,347,843)
TOTAL Increase	**$-**	**$ 38,687,155**	**$ 35,141,742**	**$ 39,945,225**	**$ 35,284,921**
Total Tons Managed	5,443,965	5,443,965	5,443,965	5,443,965	5,443,965
Total Tons Recovered	-	306,187	340,761	719,298	718,663
MTCO2E	-	1,035,760	996,209	1,049,438	1,029,087
Cost per Ton Managed	$ 97.63	$ 104.74	$ 104.09	$ 104.97	$ 104.12
Additional Cost per Ton Recovered	n/a	$ 126.35	$ 103.13	$ 55.53	$ 49.10
Additional Cost per MTCO2E	n/a	$ 37.35	$ 35.28	$ 38.06	$ 34.29

Northern California A (Rural)

Figure 5-3 below illustrates the estimated results for Northern California A (Rural). This is the second smallest region with only 224,943 tons of disposal in 2008. The cost estimates demonstrate that the Northern California A (Rural) baseline commercial system costs (i.e., to collect and dispose of all 224,943 tons) total approximately$ 25 million annually and that the proposed regulation would result in an additional cost of $4.0 million (Scenario 2) to $6.0 million (Scenario 4) per year. This represents a regional system cost increase of 16.3% to 24.4%.

Figure 5-3. Northern California A (Rural) Summary of Results

	Northern California A (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 13,756,214	$ 19,557,634	$ 19,234,369	$ 21,551,695	$ 21,473,141
Annual Processing Subtotal	$-	$ 1,164,950	$ 1,079,377	$ 1,516,027	$ 1,415,239
Annual Transportation Subtotal	$-	$ 236,403	$ 227,400	$ 420,184	$ 397,102
Annual Disposal Subtotal	$ 11,220,769	$ 10,467,617	$ 10,486,885	$ 9,483,004	$ 9,581,210
Annual Commodity Subtotal	$-	$ (2,147,093)	$ (1,986,053)	$ (1,926,239)	$ (1,804,810)
TOTAL Annual Cost/(Savings)	**$ 24,976,982**	**$ 29,279,511**	**$ 29,041,978**	**$ 31,044,671**	**$ 31,061,881**
Annual Cost Increase					
Collection Increase	$-	$ 5,801,420	$ 5,478,156	$ 7,795,481	$ 7,716,927
Processing Increase	$-	$ 1,164,950	$ 1,079,377	$ 1,516,027	$ 1,415,239
Transportation Increase	$-	$ 236,403	$ 227,400	$ 420,184	$ 397,102
Disposal Increase	$-	$ (753,152)	$ (733,884)	$ (1,737,764)	$ (1,639,559)
Commodity Increase	$-	$ (2,147,093)	$ (1,986,053)	$ (1,926,239)	$ (1,804,810)
TOTAL Increase	**$-**	**$ 4,302,528**	**$ 4,064,996**	**$ 6,067,689**	**$ 6,084,898**
Total Tons Managed	224,943	224,943	224,943	224,943	224,943
Total Tons Recovered	-	15,098	14,712	34,837	32,868
MTCO2E	-	51,075	43,011	50,826	47,066
Cost per Ton Managed	$ 111.04	$ 130.16	$ 129.11	$ 138.01	$ 138.09
Additional Cost per Ton Recovered	n/a	$ 284.97	$ 276.30	$ 174.17	$ 185.13
Additional Cost per MTCO2E	n/a	$ 84.24	$ 94.51	$ 119.38	$ 129.29

Northern California B (Urban)

Northern California B (Urban) represents the most geographically diverse and the least cost-effective (in terms of both cost per ton diverted and cost per ton of emissions reductions) recovery of materials relative to the other urban regions included in the study. The region is comprised of counties that are generally rural in nature but have one or two larger cities (i.e., Salinas, Monterey, Merced, Fresno, Visalia, Roseville, Chico, etc.) that generate a sufficient volume of waste to characterize them as urban. These larger cities have economies of scale and labor wage rates that would likely make their specific costs closer to those in other urban regions. However, when included with the rest of their regions, the cost-effectiveness appears relatively low due to the inefficiencies resulting from the less urbanized areas of the region.

The cost estimates demonstrate that the Northern California B (Urban) baseline commercial system costs (i.e., to collect and dispose of all 1.5 million tons) total approximately$ 194 million annually and that the proposed regulation would result in an additional cost of$ 23 million

(Scenario 2) to$ 36 million (Scenario 3) per year. This represents a regional system cost increase of 12.0% to 19.0%.

Figure 5-4. Northern California B (Urban) Summary of Results

	Northern California B (Urban)				
	Baseline	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Annual Collection Subtotal	$ 105,687,687	$ 142,975,125	$ 141,185,699	$ 158,587,859	$ 155,972,444
Annual Processing Subtotal	$-	$ 5,996,412	$ 5,609,760	$ 8,370,015	$ 7,853,939
Annual Transportation Subtotal	$-	$ 2,586,550	$ 2,432,481	$ 3,340,720	$ 3,143,229
Annual Disposal Subtotal	$ 88,783,766	$ 82,612,502	$ 82,813,939	$ 74,440,037	$ 75,298,496
Annual Commodity Subtotal	$-	$ (15,489,967)	$ (14,307,594)	$ (13,409,447)	$ (12,555,230)
TOTAL Annual Cost/(Savings)	**$ 194,471,453**	**$ 218,680,622**	**$ 217,734,285**	**$ 231,329,184**	**$ 229,712,878**
Annual Cost Increase					
Collection Increase	$-	$ 37,287,438	$ 35,498,012	$ 52,900,172	$ 50,284,757
Processing Increase	$-	$ 5,996,412	$ 5,609,760	$ 8,370,015	$ 7,853,939
Transportation Increase	$-	$ 2,586,550	$ 2,432,481	$ 3,340,720	$ 3,143,229
Disposal Increase	$-	$ (6,171,264)	$ (5,969,827)	$ (14,343,729)	$ (13,485,270)
Commodity Increase	$-	$ (15,489,967)	$ (14,307,594)	$ (13,409,447)	$ (12,555,230)
TOTAL Increase	**$-**	**$ 24,209,169**	**$ 23,262,833**	**$ 36,857,731**	**$ 35,241,425**
Total Tons Managed	1,551,584	1,551,584	1,551,584	1,551,584	1,551,584
Total Tons Recovered	-	107,849	104,329	250,671	235,668
MTCO2E	-	364,828	305,003	365,723	337,465
Cost per Ton Managed	$ 125.34	$ 140.94	$ 140.33	$ 149.09	$ 148.05
Additional Cost per Ton Recovered	n/a	$ 224.47	$ 222.98	$ 147.04	$ 149.54
Additional Cost per MTCO2E	n/a	$ 66.36	$ 76.27	$ 100.78	$ 104.43

Northern California B (Rural)

Figure 5-5 below illustrates the results of the cost estimates for the Northern California B (Rural) region. This is the largest (in terms of geographical area), most geographically diverse, and least cost-effective region (in terms of cost per recovered ton) considered in this study. With 23 counties and only 741,410 tons of waste disposed in 2008, each county disposes of an average of approximately 32,235 tons. This results in low collection densities and poor economies of scale for developing facilities to process or compost materials.

The cost estimates demonstrate that the Northern California B (Rural) baseline commercial system costs (i.e., to collect and dispose of all 741,410 tons) total approximately$ 112 million annually and that the proposed regulation would result in an additional cost of$ 15 million

(Scenario 2) to$ 45 million (Scenario 3) per year. This represents a regional system cost increase of 13.6% to 39.9%. This range of increases results from various approaches to implementing programs to respond to this regulation. In the Northern California B (Rural) region, this range reflects relatively few communities having aggressively implemented commercial recycling and organics programs to date, resulting in lower cost-effectiveness as such programs are developed.

Figure 5-5. Northern California B (Rural) Summary of Results

	Northern California B (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 77,261,411	$ 97,838,016	$ 96,614,509	$ 127,037,687	$ 123,792,579
Annual Processing Subtotal	$-	$ 3,454,917	$ 3,203,091	$ 4,325,069	$ 4,042,603
Annual Transportation Subtotal	$-	$ 1,311,322	$ 1,240,977	$ 1,814,931	$ 1,711,911
Annual Disposal Subtotal	$ 34,539,568	$ 32,286,094	$ 32,338,282	$ 29,183,990	$ 29,486,358
Annual Commodity Subtotal	$-	$ (6,915,323)	$ (6,399,146)	$ (6,000,842)	$ (5,628,286)
TOTAL Annual Cost/(Savings)	**$ 111,800,979**	**$ 127,975,026**	**$ 126,997,712**	**$ 156,360,834**	**$ 153,405,165**
Annual Cost Increase					
Collection Increase	$-	$ 20,576,605	$ 19,353,098	$ 49,776,276	$ 46,531,168
Processing Increase	$-	$ 3,454,917	$ 3,203,091	$ 4,325,069	$ 4,042,603
Transportation Increase	$-	$ 1,311,322	$ 1,240,977	$ 1,814,931	$ 1,711,911
Disposal Increase	$-	$ (2,253,474)	$ (2,201,286)	$ (5,355,578)	$ (5,053,210)
Commodity Increase	$-	$ (6,915,323)	$ (6,399,146)	$ (6,000,842)	$ (5,628,286)
TOTAL Increase	**$-**	**$ 16,174,047**	**$ 15,196,734**	**$ 44,559,856**	**$ 41,604,186**
Total Tons Managed	741,410	741,410	741,410	741,410	741,410
Total Tons Recovered	-	48,372	47,252	114,960	108,470
MTCO2E	-	163,631	138,140	167,724	155,323
Cost per Ton Managed	$ 150.80	$ 172.61	$ 171.29	$ 210.90	$ 206.91
Additional Cost per Ton Recovered	n/a	$ 334.37	$ 321.61	$ 387.61	$ 383.56
Additional Cost per MTCO2E	n/a	$ 98.84	$ 110.01	$ 265.67	$ 267.86

Southern California A (Urban)

Southern California A (Urban) is the largest region in the study in terms of the volume of waste generation at over 18 million tons per year (approximately 67% of the statewide tons disposed in 2008). This region demonstrates the greatest level of cost-effectiveness of any of the regions in this study, particularly under the scenarios that include C&D recycling programs (Scenarios 2 and 4). This is a function of the high level of efficiency in collecting those materials and the relatively low cost of processing them.

The cost estimates demonstrate that the Southern California A (Urban) baseline commercial system costs (i.e., to collect and dispose of all 18 million tons) total approximately$ 1.5 billion annually and that the proposed regulation may result in an additional cost of nearly $39 million (Scenario 2) to $99 million (Scenario 3) per year. This represents a regional system cost increase of 2.5% to 6.3%.

Figure 5-6. Southern California A (Urban) Summary of Results

	Southern California A (Urban)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 789,639,274	$ 939,803,870	$ 926,668,259	$ 979,314,238	$ 938,858,169
Annual Processing Subtotal	$ -	$ 72,692,329	$ 72,016,173	$ 97,469,578	$ 96,128,904
Annual Transportation Subtotal	$ -	$ 11,538,862	$ 15,159,606	$ 22,709,180	$ 25,048,949
Annual Disposal Subtotal	$ 784,725,189	$ 745,281,412	$ 736,681,992	$ 693,989,427	$ 689,884,478
Annual Commodity Subtotal	$ -	$ (135,338,953)	$ (137,350,159)	$ (119,775,127)	$ (122,506,542)
TOTAL Annual Cost/(Savings)	**$ 1,574,364,463**	**$ 1,633,977,519**	**$ 1,613,175,871**	**$ 1,673,707,296**	**$ 1,627,413,958**
Annual Cost Increase					
Collection Increase	$ -	$ 150,164,596	$ 137,028,985	$ 189,674,964	$ 149,218,895
Processing Increase	$ -	$ 72,692,329	$ 72,016,173	$ 97,469,578	$ 96,128,904
Transportation Increase	$ -	$ 11,538,862	$ 15,159,606	$ 22,709,180	$ 25,048,949
Disposal Increase	$ -	$ (39,443,777)	$ (48,043,197)	$ (90,735,762)	$ (94,840,711)
Commodity Increase	$ -	$ (135,338,953)	$ (137,350,159)	$ (119,775,127)	$ (122,506,542)
TOTAL Increase	**$ -**	**$ 59,613,056**	**$ 38,811,408**	**$ 99,342,833**	**$ 53,049,495**
Total Tons Managed	18,601,026	18,601,026	18,601,026	18,601,026	18,601,026
Total Tons Recovered	-	934,970	1,138,810	2,150,789	2,248,092
MTCO2E	-	3,162,791	3,329,292	3,137,949	3,219,149
Cost per Ton Managed	$ 84.64	$ 87.84	$ 86.73	$ 89.98	$ 87.49
Additional Cost per Ton Recovered	n/a	$ 63.76	$ 34.08	$ 46.19	$ 23.60
Additional Cost per MTCO2E	n/a	$ 18.85	$ 11.66	$ 31.66	$ 16.48

Southern California B (Urban)

Figure 5-7 below illustrates the results of the cost estimation for the Southern California B (Urban) region. Similar to the Northern California B (Urban) region, the counties in this region are generally rural in nature with a few large cities (e.g., Bakersfield, El Centro, San Luis Obispo, and Santa Barbara) that would otherwise represent cost estimates that were similar to other urban regions.

The cost estimates demonstrate that the Southern California B (Urban) baseline commercial system costs (i.e., to collect and dispose of all 928,493 tons) total approximately$ 92 million annually and that the proposed regulation would result in an additional cost of$ 13 million (Scenarios 1 and 2) to$ 21 million (Scenario 3) per year. This represents a regional system cost increase of 14.0% to 22.7%.

Figure 5-7. Southern California B (Urban) Summary of Results

	Southern California B (Urban)				
	Baseline	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Annual Collection Subtotal	$ 53,058,604	$ 72,157,364	$ 71,491,880	$ 80,488,803	$ 79,228,916
Annual Processing Subtotal	$-	$ 3,399,481	$ 3,122,238	$ 4,895,289	$ 4,541,824
Annual Transportation Subtotal	$-	$ 1,353,759	$ 1,306,210	$ 2,015,632	$ 1,918,916
Annual Disposal Subtotal	$ 38,840,396	$ 36,349,490	$ 36,392,916	$ 32,911,274	$ 33,232,351
Annual Commodity Subtotal	$-	$ (8,510,865)	$ (7,889,606)	$ (7,573,246)	$ (7,111,365)
TOTAL Annual Cost/(Savings)	**$ 91,899,000**	**$ 104,749,229**	**$ 104,423,638**	**$ 112,737,751**	**$ 111,810,642**
Annual Cost Increase					
Collection Increase	$-	$ 19,098,760	$ 18,433,276	$ 27,430,198	$ 26,170,312
Processing Increase	$-	$ 3,399,481	$ 3,122,238	$ 4,895,289	$ 4,541,824
Transportation Increase	$-	$ 1,353,759	$ 1,306,210	$ 2,015,632	$ 1,918,916
Disposal Increase	$-	$ (2,490,906)	$ (2,447,480)	$ (5,929,122)	$ (5,608,046)
Commodity Increase	$-	$ (8,510,865)	$ (7,889,606)	$ (7,573,246)	$ (7,111,365)
TOTAL Increase	**$-**	**$ 12,850,229**	**$ 12,524,638**	**$ 20,838,750**	**$ 19,911,642**
Total Tons Managed	928,493	928,493	928,493	928,493	928,493
Total Tons Recovered	-	59,546	58,508	141,738	134,062
MTCO2E	-	201,430	171,047	206,792	191,970
Cost per Ton Managed	$ 98.98	$ 112.82	$ 112.47	$ 121.42	$ 120.42
Additional Cost per Ton Recovered	n/a	$ 215.80	$ 214.07	$ 147.02	$ 148.53
Additional Cost per MTCO2E	n/a	$ 63.79	$ 73.22	$ 100.77	$ 103.72

Southern California B (Rural)

As illustrated in Figure 5-8 below, Southern California B (Rural) generates the least waste (91,169 tons in 2008) of all of the regions in the study. It is also made up of three of the most remote and rural counties in the State. While this region benefits the least from economies of scale (averaging only 30,390 tons per county) of any region in the study, costs are relatively low as a result of having the lowest assumed hourly wage rates and management salaries in the State.

The cost estimates demonstrate that the Southern California B (Rural) baseline commercial system costs (i.e., to collect and dispose of all 91,169 tons) total approximately$ 13.5 million annually and that the proposed regulation would result in an additional cost of$ 1.1 million (Scenarios 1 and 2) to$ 4.4 million (Scenario 3) per year. This represents a regional system cost increase of 7.6% to 32.7%.

Figure 5-8. Southern California B (Rural) Summary of Results

	Southern California B (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Annual Collection Subtotal	$ 8,956,508	$ 10,387,056	$ 10,385,157	$ 13,939,866	$ 13,411,716
Annual Processing Subtotal	$-	$ 555,189	$ 507,398	$ 654,268	$ 605,930
Annual Transportation Subtotal	$-	$ 205,090	$ 196,186	$ 242,177	$ 231,169
Annual Disposal Subtotal	$ 4,515,244	$ 4,215,340	$ 4,222,192	$ 3,783,766	$ 3,825,573
Annual Commodity Subtotal	$-	$ (861,153)	$ (797,091)	$ (749,413)	$ (703,013)
TOTAL Annual Cost/(Savings)	**$ 13,471,753**	**$ 14,501,522**	**$ 14,513,841**	**$ 17,870,664**	**$ 17,371,376**
Annual Cost Increase					
Collection Increase	$-	$ 1,430,547	$ 1,428,648	$ 4,983,358	$ 4,455,208
Processing Increase	$-	$ 555,189	$ 507,398	$ 654,268	$ 605,930
Transportation Increase	$-	$ 205,090	$ 196,186	$ 242,177	$ 231,169
Disposal Increase	$-	$ (299,904)	$ (293,052)	$ (731,478)	$ (689,671)
Commodity Increase	$-	$ (861,153)	$ (797,091)	$ (749,413)	$ (703,013)
TOTAL Increase	**$-**	**$ 1,029,770**	**$ 1,042,089**	**$ 4,398,912**	**$ 3,899,624**
Total Tons Managed	91,169	91,169	91,169	91,169	91,169
Total Tons Recovered	-	6,055	5,917	14,770	13,925
MTCO2E	-	20,484	17,299	21,548	19,940
Cost per Ton Managed	$ 147.77	$ 159.06	$ 159.20	$ 196.02	$ 190.54
Additional Cost per Ton Recovered	n/a	$ 170.06	$ 176.11	$ 297.84	$ 280.04
Additional Cost per MTCO2E	n/a	$ 50.27	$ 60.24	$ 204.14	$ 195.56

Mandatory Commercial Recycling Cost Model Methodology

The following discussion documents the methodology used to develop the cost estimates.

General Assumptions

In addition to the assumptions and limitations described in Section 1, the following general assumptions were used in the estimation of costs. These general assumptions are key variables in the estimates and changes to these assumptions would have a significant impact on the results.

DEPRECIATION VERSUS CAPITAL EXPENSE

The estimates are based on the assumption that new and existing equipment will be depreciated over the useful life of the equipment and not treated as a one-time expense.

MARKET BASED SYSTEM VARIABLES

For the processing, transportation, and disposal elements of the model, the data gathered was not sufficiently detailed to accurately estimate the costs. Instead, market-based pricing information was gathered from service providers based on their charges to large volume or municipal customers. In each case where costs were estimated using the market-based pricing approach, more detailed – though limited – data gathered from the industry provided the basis for allocating costs among cost categories (i.e., labor, fuel, depreciation, repairs and maintenance, and other costs).

For example, in the Northern California A (Urban) region five data points were available for the total processing cost per ton for single-stream recyclables. The weighted average cost per ton resulting from those five data points results in an assumption that the average total processing cost for that region is$ 90.95 per ton. Only one data point for that region was available that provides single-stream processing costs disaggregated into the cost categories used for this study. That more detailed data evidenced that, for example, the labor-related costs were 48.8% of the total operating costs. Therefore, the assumed value for the labor-related costs of single-stream processing in Northern California A (Urban) equal$ 44.36, or 48.8% of the$ 90.95 per ton.

INFLATION OF HISTORICAL COSTS AND PROJECTION OF FORECASTED COSTS

A significant volume of cost data were gathered from HF&H's project files and databases for rate review and procurement projects performed since 2005. In order to normalize this data into 2008 dollars, the costs presented in 2005, 2006, and 2007 dollars were inflated to 2008 dollars using indices from the US Bureau of Labor Statistics based on the type of cost inflated (i.e., Labor, Fuel, Repair & Maintenance, Depreciation, and Other costs). Similarly, costs that were presented in 2009 or 2010 dollars were deflated using the same indices. It is assumed that these indices would effectively normalize the cost information presented for other years.

Interpretation of Results

STATEWIDE VERSUS REGIONAL-LEVEL PRECISION

This study estimates statewide costs as well as cost differences among regions. In addition, it considers differences between urban and rural areas. Data was gathered on a regional basis and costs, savings, and net costs statewide were determined using the regional information; therefore, the information presented for statewide costs is not representative of any specific region, rural or urban, but rather a weighted average of the regional costs.

COMMUNITY/BUSINESS-LEVEL PRECISION

The cost-effectiveness for a specific business or jurisdiction may vary significantly based on a number of factors including, but not limited to, program design, regional disposal and recovery infrastructure and pricing, business terms of collection or processing agreements, incentive pricing strategies (e.g., subsidies to reduce the price of recycling to the customer), and jurisdictional fees (e.g., franchise, AB939, contract management, etc.) included in collection rates. It should be noted that the regions used in this study are necessarily large and represent a blending of community-specific costs. For example, a service provider or business in Sacramento County may perceive that the costs for their region (Northern California A Urban) appear significantly higher than the costs they are actually experiencing. Contrarily, a service provider or business in San Mateo County may perceive that the costs for that same region appear significantly lower than the costs they are actually experiencing. This is the result of the blending of costs within a region.

USES AND LIMITATIONS OF RESULTS

The data used in the cost estimates was specifically gathered and tabulated for the purposes of CalRecycle's and ARB's determination of the cost, savings, and net costs associated with achieving the 5MMTCO2E emissions reduction target. Uses of these cost estimates by others for other purposes (e.g., a private hauler and city negotiating a rate increase) are unauthorized and are likely to misinterpret the results because specific conditions could be significantly different than those assumed herein.

Sources and Uses of Data

DATA GATHERING PROCESS PARTICIPANTS & SOURCES OF DATA

As described in Section 2, the data underlying the study was gathered in a three-step process. The first step in the process was to solicit the required data through surveys and data gathering forms which were distributed to private and public sector haulers, processors, composters, and material brokers. The data gathered in that process was then supplemented with data from HF&H's project files from dozens of projects since 2005 where similar data was gathered from either private or public sector service providers. While these two sources of data provided nearly all of the information necessary, literature searches and research were used to both validate existing data and to provide additional data where the other sources were incomplete.

In order to secure the participation of private companies in the data gathering process, HF&H provided assurances to each data provider that specific source data would be held confidentially and not provided to CalRecycle or used for any other purpose. To honor this commitment, all data for the economic study is presented herein as regional totals or averages.

USES OF DATA

Based on the level of detail of the data gathered, HF&H used one of three primary approaches to calculating results for the purposes of this study.

1. Cost-of-Service – Sufficient data at a sufficient level of detail was available on the collection element of the system to allow for cost-of-service calculations. To do this, HF&H constructed a model to estimate operational demands (e.g., labor and equipment requirements) based on productivity (e.g., lifts per hour) and customer demand (e.g., average cubic yards per set-out). The model then incorporates cost factors (e.g., hourly labor rates, cost per container, cost per vehicle, etc.) to the operational requirements to estimate the total collection costs. This approach provides a greater level of precision in estimating costs by type (i.e., labor, fuel, repairs and maintenance, depreciation, and other) than either of the other two approaches described below. This approach is also less sensitive to changes in individual assumptions regarding key variables because the total number of assumptions regarding such variables is greater.

2. Market-Based-Pricing – For the processing, transportation, and disposal elements of the model, the cost data gathered was not sufficiently detailed, representative, or comprehensive to estimate the costs as described above. Instead, pricing information was gathered from service providers based on their charges to large volume or municipal customers. In each case where HF&H used the market-based pricing approach, more detailed – though limited – data gathered from the industry provided the basis for allocating costs among cost categories. For example, pricing information for processing at a single stream MRF was readily available for most regions. However, detailed costs by cost category were only available from three regions, and usually only from a single provider in that region. In these cases, that cost category information was applied to other similar regions (e.g., Northern California B Rural was assumed to be similar to Southern California B Rural).
3. Commodity Pricing – Data for the value of materials sold at market was gathered from SecondaryMaterialsPricing.com and SecondaryFiberPricing.com, both published by Waste & Recycling News, using values reported for the Southwestern United States. Data for the value of compost, wood waste, and inert materials was gathered from the industry and from literature review during the data gathering process. Commodity prices were calculated using the average of all values reported during the 2009 calendar year.

SYSTEM COMPONENTS & COST CATEGORIES

Within each scenario, the costs for each region were categorized into the following system components and presented by target material type: the cost of collecting the materials (collection costs), the cost of processing the recovered materials (processing costs), the cost of transporting the recovered materials for sale in export or domestic markets (transportation costs), the revenue generated by selling recovered materials in export or domestic markets (commodity revenue), and the cost of disposing materials in a landfill (disposal costs).

For each system component, data was collected using the following cost categories: labor, fuel (energy), depreciation, repairs & maintenance, and other costs. While the collection estimates include the cost of fuel used by collection trucks, the processing estimates include both the fuel consumed by rolling stock and the cost to power the processing facility and equipment.

Sensitivity

MARKET-BASED PRICING

When the pricing approach was used, it assumed that the price would cover the cost of providing the service plus profit.

For example, many processors will seek competitive bids for hauling recyclables to market because trucking companies can provide pricing below the processor's cost of trucking their own materials. This is the case because trucking and logistics companies have relationships that allow them to fill their back-hauls with another customer's load where the processor would pay the round trip cost with their own equipment. Conversely, disposal pricing (particularly for privately-owned landfills) is frequently based on the level of competition among landfill owner/operators in the area.

This pricing approach, as opposed to the detailed cost approach, is relatively more sensitive to changes in the assumed values. For example, a two dollar change in collection driver wage rates does not equate to a two dollar change in the per ton cost of collection using the cost approach. This is because there are a number of other factors contributing to the labor costs in the collection estimates. However, a two dollar change in the governmental fees assumed at a landfill will result in a two dollar change in the cost of disposal.

Cost versus Total Economic Impact

The purpose of this study is to estimate the direct cost and cost savings resulting from the implementation of the proposed regulation, not its total economic impacts. While this study generally quantifies the direct costs and savings resulting from the proposed regulation, a more comprehensive economic analysis would include but not be limited to: a determination of the indirect costs and cost savings, secondary and tertiary job creation impacts, estimates of the long-term liabilities associated with landfills, and impacts of collection and transportation vehicles in terms of pavement management costs.

Relative Impact of Changes to Key Assumptions

The estimates assume certain values for key factors, among other things, employee productivity, staffing ratios, employee benefits, tonnage distribution (both among regions and material types), and equipment costs. Changes in the following assumptions may significantly impact the results: number of recovered tons required to achieve the emissions reduction target, route density, route productivity, and percentage of front end loader collection versus roll-off collection. Differences in the material types collected also have an effect on the average cost. For example, higher volumes of organic materials collected will increase the weighted average cost for the region and statewide. Conversely, higher volumes of C&D collected will reduce the average cost for the region and the State. Changes to the assumptions would result in different estimated costs and those differences can be significant.

Collection Analysis

The following discussion provides a summary of the findings of the collection analysis followed by a summary of the methodology underlying that analysis.

Collection Findings by Region & Scenario

Figures 5-9 through 5-12 on the following pages present a summary of the results of the collection analysis by region. Each figure presents, for each region and statewide, the cost, by cost category, of collecting the recovered tons along with the cost of all tons collected, both recovered and disposed. The subtotal costs are divided by the tons of material that are collected in the region, not including self-hauled material, to get a collection cost per ton. Collection costs for self-hauled material are not included in this analysis because the costs for each self-hauler are widely variable and are not likely to change significantly as a result of this regulation. It is assumed that materials that are currently self-hauled would continue to be self-hauled and that the costs of that activity would not change significantly.

Figure 5-9. Scenario 1 Collection Cost Summary by Region

	Scenario 1 - Traditional Recyclable Materials							
	Northern California A (Urban)		Northern California A (Rural)		Northern California B (Urban)		Northern California B (Rural)	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 14,820,014	$ 118,710,719	$ 1,027,266	$ 5,512,285	$ 6,856,929	$ 41,303,628	$ 3,621,872	$ 20,327,036
Fuel Costs	$ 3,225,044	$ 25,752,383	$ 268,505	$ 1,499,765	$ 1,949,295	$ 11,757,830	$ 1,054,925	$ 5,923,664
Repairs & Maintenance	$ 5,761,817	$ 57,846,557	$ 547,858	$ 2,958,432	$ 4,502,670	$ 23,372,547	$ 852,824	$ 7,564,916
Direct Depreciation	$ 3,441,764	$ 28,838,434	$ 358,964	$ 1,873,424	$ 2,396,240	$ 13,757,558	$ 1,637,870	$ 8,374,437
Other Costs	$ 15,830,186	$ 128,738,171	$ 1,528,934	$ 7,713,728	$ 9,786,008	$ 52,783,562	$ 9,915,351	$ 55,647,963
Annual Collection Subtotal	**$ 43,078,825**	**$ 359,886,266**	**$ 3,731,527**	**$ 19,557,634**	**$ 25,491,142**	**$ 142,975,125**	**$ 17,082,842**	**$ 97,838,016**
Collection Cost/(Savings) per Ton	$ 151.73	$ 89.94	$ 259.08	$ 106.19	$ 243.78	$ 105.69	$ 370.77	$ 161.28

	Southern California A		Southern California B (Urban)		Southern California B (Rural)		State of California	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 43,333,097	$ 298,853,308	$ 2,933,281	$ 19,640,752	$ 375,310	$ 2,118,897	$ 72,967,769	$ 506,466,625
Fuel Costs	$ 11,726,724	$ 81,106,406	$ 899,746	$ 5,985,817	$ 132,036	$ 726,686	$ 19,256,275	$ 132,752,550
Repairs & Maintenance	$ 23,873,087	$ 157,704,445	$ 1,730,518	$ 13,122,895	$ 176,768	$ 639,361	$ 37,445,543	$ 263,209,154
Direct Depreciation	$ 13,569,970	$ 89,129,230	$ 1,125,985	$ 6,893,097	$ 188,781	$ 1,014,526	$ 22,719,574	$ 149,880,705
Other Costs	$ 49,704,794	$ 313,010,482	$ 4,162,318	$ 26,514,803	$ 1,151,987	$ 5,887,586	$ 92,079,577	$ 590,296,295
Annual Collection Subtotal	**$ 142,207,673**	**$ 939,803,870**	**$ 10,851,848**	**$ 72,157,364**	**$ 2,024,881**	**$ 10,387,056**	**$ 244,468,737**	**$ 1,642,605,330**
Collection Cost/(Savings) per Ton	$ 152.10	$ 76.34	$ 182.24	$ 102.74	$ 334.39	$ 139.93	$ 165.40	$ 85.41

Figure 5-10. Scenario 2 Collection Cost Summary by Region

	Scenario 2 - Traditional Recyclable and C&D Materials							
	Northern California A (Urban)		Northern California A (Rural)		Northern California B (Urban)		Northern California B (Rural)	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 13,849,116	$ 117,708,116	$ 938,070	$ 5,423,089	$ 6,197,398	$ 40,839,772	$ 3,270,531	$ 20,061,326
Fuel Costs	$ 2,976,364	$ 25,494,631	$ 241,870	$ 1,482,308	$ 1,760,211	$ 11,629,755	$ 950,094	$ 5,853,446
Repairs & Maintenance	$ 5,410,809	$ 57,418,351	$ 498,551	$ 2,909,125	$ 4,070,573	$ 23,044,365	$ 768,543	$ 7,521,941
Direct Depreciation	$ 3,176,324	$ 28,495,447	$ 324,469	$ 1,841,942	$ 2,165,536	$ 13,586,857	$ 1,471,149	$ 8,250,313
Other Costs	$ 14,714,375	$ 127,514,091	$ 1,385,291	$ 7,577,905	$ 8,844,603	$ 52,084,951	$ 8,928,295	$ 54,927,483
Annual Collection Subtotal	**$ 40,126,988**	**$ 356,630,636**	**$ 3,388,251**	**$ 19,234,369**	**$ 23,038,321**	**$ 141,185,699**	**$ 15,388,613**	**$ 96,614,509**
Collection Cost/(Savings) per Ton	$ 141.75	$ 89.13	$ 257.92	$ 104.44	$ 238.60	$ 104.37	$ 366.01	$ 159.26
	Southern California A		Southern California B (Urban)		Southern California B (Rural)		State of California	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 39,944,055	$ 295,083,581	$ 2,661,154	$ 19,460,389	$ 369,344	$ 2,112,931	$ 67,229,668	$ 500,689,204
Fuel Costs	$ 10,797,255	$ 80,096,658	$ 810,694	$ 5,934,778	$ 118,916	$ 717,895	$ 17,655,404	$ 131,209,470
Repairs & Maintenance	$ 22,003,936	$ 155,547,571	$ 1,571,074	$ 13,029,735	$ 176,768	$ 639,361	$ 34,500,254	$ 260,110,448
Direct Depreciation	$ 12,380,520	$ 87,634,572	$ 1,015,302	$ 6,818,863	$ 183,944	$ 1,011,529	$ 20,717,244	$ 147,639,523
Other Costs	$ 45,519,563	$ 308,305,878	$ 3,762,209	$ 26,248,116	$ 1,159,785	$ 5,903,440	$ 84,314,122	$ 582,561,864
Annual Collection Subtotal	**$ 130,645,328**	**$ 926,668,259**	**$ 9,820,433**	**$ 71,491,880**	**$ 2,008,757**	**$ 10,385,157**	**$ 224,416,691**	**$ 1,622,210,509**
Collection Cost/(Savings) per Ton	$ 114.72	$ 75.27	$ 167.85	$ 101.79	$ 339.48	$ 139.90	$ 131.22	$ 84.35

Figure 5-11. Scenario 3 Collection Cost Summary by Region

	Scenario 3 - Traditional Recyclable and Organic Materials							
	Northern California A (Urban)		Northern California A (Rural)		Northern California B (Urban)		Northern California B (Rural)	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 25,995,046	$ 119,600,298	$ 2,093,472	$ 6,055,265	$ 15,132,038	$ 45,783,581	$ 11,072,595	$ 25,992,210
Fuel Costs	$ 5,594,619	$ 25,871,045	$ 582,466	$ 1,679,288	$ 4,272,022	$ 13,016,493	$ 3,194,775	$ 7,525,855
Repairs & Maintenance	$ 11,813,479	$ 58,843,048	$ 1,128,587	$ 3,265,233	$ 8,961,220	$ 25,773,645	$ 4,311,949	$ 10,352,364
Direct Depreciation	$ 5,977,305	$ 28,960,690	$ 714,122	$ 2,002,602	$ 4,962,863	$ 15,130,049	$ 4,504,696	$ 10,541,862
Other Costs	$ 28,762,617	$ 130,593,064	$ 3,107,082	$ 8,549,306	$ 20,568,528	$ 58,884,091	$ 31,716,798	$ 72,625,396
Annual Collection Subtotal	**$ 78,143,066**	**$ 363,868,145**	**$ 7,625,730**	**$ 21,551,695**	**$ 53,896,672**	**$ 158,587,859**	**$ 54,800,814**	**$ 127,037,687**
Collection Cost/(Savings) per Ton	$ 118.57	$ 90.94	$-	$ 117.02	$ 222.92	$ 117.23	$-	$ 209.41
	Southern California A		Southern California B (Urban)		Southern California B (Rural)		State of California	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 79,893,201	$ 311,360,285	$ 7,259,135	$ 22,131,289	$ 1,270,414	$ 2,854,202	$ 142,715,901	$ 533,777,130
Fuel Costs	$ 21,604,319	$ 84,436,443	$ 2,187,667	$ 6,694,860	$ 412,248	$ 936,356	$ 37,848,116	$ 140,160,341
Repairs & Maintenance	$ 43,306,333	$ 164,657,140	$ 4,011,302	$ 14,198,077	$ 394,227	$ 816,025	$ 73,927,098	$ 277,905,532
Direct Depreciation	$ 23,302,342	$ 92,019,684	$ 2,540,314	$ 7,692,303	$ 595,297	$ 1,345,112	$ 42,596,939	$ 157,692,302
Other Costs	$ 88,137,812	$ 326,840,687	$ 9,849,918	$ 29,772,272	$ 3,705,776	$ 7,988,172	$ 185,848,532	$ 635,252,988
Annual Collection Subtotal	**$ 256,244,006**	**$ 979,314,238**	**$ 25,848,336**	**$ 80,488,803**	**$ 6,377,963**	**$ 13,939,866**	**$ 482,936,586**	**$ 1,744,788,293**
Collection Cost/(Savings) per Ton	$ 119.14	$ 79.55	$ 182.37	$ 114.60	$ 431.83	$ 187.79	$ 140.92	$ 90.72

Figure 5-12. Scenario 4 Collection Cost Summary by Region

	Scenario 4 - All Tons Excluding Solid Waste							
	Northern California A (Urban)		Northern California A (Rural)		Northern California B (Urban)		Northern California B (Rural)	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 24,071,712	$ 118,326,547	$ 1,896,170	$ 6,067,619	$ 13,871,907	$ 45,107,678	$ 10,163,236	$ 25,350,216
Fuel Costs	$ 5,174,860	$ 25,626,951	$ 531,626	$ 1,648,212	$ 3,903,113	$ 12,793,893	$ 2,914,684	$ 7,323,501
Repairs & Maintenance	$ 10,939,437	$ 58,221,507	$ 1,013,537	$ 3,259,754	$ 8,206,251	$ 25,336,077	$ 3,962,390	$ 10,104,659
Direct Depreciation	$ 5,355,262	$ 28,426,812	$ 646,922	$ 1,985,466	$ 4,536,776	$ 14,884,620	$ 4,138,502	$ 10,281,797
Other Costs	$ 25,945,191	$ 128,421,256	$ 2,820,292	$ 8,512,090	$ 18,825,400	$ 57,850,175	$ 29,101,587	$ 70,732,406
Annual Collection Subtotal	**$ 71,486,461**	**$ 359,023,073**	**$ 6,908,546**	**$ 21,473,141**	**$ 49,343,446**	**$ 155,972,444**	**$ 50,280,400**	**$ 123,792,579**
Collection Cost/(Savings) per Ton	$ 113.99	$ 89.73	$ 228.54	$ 116.59	$ 221.39	$ 115.30	$ 504.09	$ 204.06
	Southern California A		Southern California B (Urban)		Southern California B (Rural)		State of California	
Collection costs	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL	RECOVERED	TOTAL
Labor-Related Costs	$ 73,688,106	$ 306,710,216	$ 6,624,831	$ 21,784,789	$ 1,091,780	$ 2,749,976	$ 131,407,741	$ 526,097,041
Fuel Costs	$ 19,942,723	$ 83,231,575	$ 1,996,630	$ 6,588,269	$ 376,097	$ 910,223	$ 34,839,733	$ 138,122,624
Repairs & Maintenance	$ 39,949,195	$ 162,003,707	$ 3,660,998	$ 14,029,471	$ 333,678	$ 774,720	$ 68,065,486	$ 273,729,895
Direct Depreciation	$ 21,428,594	$ 90,367,860	$ 2,309,153	$ 7,553,594	$ 524,724	$ 1,297,871	$ 38,939,933	$ 154,798,020
Other Costs	$ 56,394,354	$ 296,544,811	$ 8,979,516	$ 29,272,794	$ 3,230,690	$ 7,678,926	$ 145,297,029	$ 599,012,457
Annual Collection Subtotal	**$ 211,402,972**	**$ 938,858,169**	**$ 23,571,128**	**$ 79,228,916**	**$ 5,556,969**	**$ 13,411,716**	**$ 418,549,922**	**$ 1,691,760,037**
Collection Cost/(Savings) per Ton	$ 94.04	$ 76.26	$ 175.82	$ 112.81	$ 399.05	$ 180.68	$ 119.87	$ 87.96

General Collection Considerations

IMPACT OF MANDATORY RECYCLING REGULATION

The productivity or efficiency of a collection system is typically measured in terms of the number of container lifts per hour and the volume collected per lift. As fewer solid waste tons are collected and more tons are recovered in response to the measure, the cost of collecting the solid waste will increase due to the reduced volume of that material present in each container that is serviced. Similarly, as more customers begin recycling and more tons are placed in recycling containers, the productivity of collecting recovered materials will increase and the cost will decrease.

EXISTENCE OF COLLECTION INFRASTRUCTURE

The base year for tonnage in this study was 2008 in order to coincide with the most recent waste characterization study. As a result of the downturn in the economy, tonnage declined in 2009. Some trucks and containers that were needed when collection volumes were higher are now sitting idle due to this decline in tonnage. The increase in cost to the system to handle the recovered materials required by the regulation may be mitigated somewhat by the use of such idled existing trucks and containers. This reduction in additional equipment has not been assumed in the estimates, so to the extent that such a reduction is realized, it would result in lower costs than are presented here.

COLLECTION TECHNOLOGIES/STRATEGIES USED

Businesses generating four or more cubic yards of material per week will be impacted by this regulation, except where local jurisdictions have more strenuous requirements (e.g., San Francisco); therefore, only those forms of waste collection that are suited to high-volume collection (i.e., front-end-loading and roll-off vehicles and containers) were considered in this study. To the extent that cart-based recycling programs could be expanded into the commercial sector, cost could be lower than demonstrated herein. This is possible if commercial could be routed with residential customers to increase the relative productivity of commercial collection. This study also did not consider the use of co-collection vehicles (i.e., vehicles with a split body that are able to separately collect recyclable materials and garbage) which, if used, particularly in rural communities, may result in more cost-effective approaches to collecting commercial recyclables. This approach was not considered in this study because its application is relatively limited in the commercial sector in California.

DEVELOPMENT OF FUTURE TECHNOLOGIES/STRATEGIES

The collection strategies used to estimate costs, net costs and savings associated with the model were based on conventional collection methods currently in place. Any changes to the current technology may affect the results presented in each scenario. For example, the model applied the estimated cost of diesel fuel per gallon when calculating fuel costs associated with the collection trucks. If the cost of fueling trucks with Compressed Natural Gas (CNG) were included in the collection costs, this may decrease the resulting fuel costs, as CNG is less costly per vehicle mile traveled, and increase the depreciation costs, as CNG vehicles are more expensive when purchased.

Operational Demand Analysis

Figures 5-13 through 5-20 below present the results of the operational demand analysis for each region, illustrating the staffing levels and equipment requirements resulting from each program scenario. The results of this operational demand analysis are that the proposed regulation may generate between 938 and 1,396 new full time equivalent recycling collection, support, supervisory, and management jobs. In addition, the statewide demand for collection vehicles may increase by as much as 40%, support vehicles by as much as 35%, and collection containers by as much as 66%. These increases in equipment demands may be somewhat lessened by the decline in the economy since 2008 (the base year for this data) which idled existing equipment as described above.

Figure 5-13. Operational Demand Summary – State of California

	State of California				
	Baseline	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Staffing Levels					
Driver	3,653	4,579	4,515	4,847	4,765
Pool Driver	559	538	532	572	564
Container Delivery	158	188	184	211	206
Dispatch	158	182	179	194	192
Route Supervisor	256	288	285	307	302
Operations Manager	186	217	214	234	231
TOTAL Headcount	**4,970**	**5,990**	**5,908**	**6,366**	**6,259**
Total Headcount Increase (from Baseline)	-	1,020	938	1,396	1,289
Equipment Needs					
Collection Vehicle - Front End Loader	3,155	3,961	3,870	4,378	4,252
Collection Vehicle - Roll-off	1,180	1,315	1,354	1,186	1,241
Container Delivery Vehicle	158	188	184	211	206
Supervisor Vehicle	442	504	499	541	533
Collection Bins (1 - 8 CY)	762,529	1,266,856	1,241,646	1,257,249	1,233,463
Collection Drop Boxes (10 - 50 CY)	28,575	31,815	32,751	28,696	29,973

Figure 5-14. Operational Demand Summary – Northern California A (Urban)

	Northern California A (Urban)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	718.00	875.00	865.00	881.00	869.00
Pool Driver	104.20	127.00	126.10	127.90	126.70
Container Delivery	28.70	36.00	35.20	37.20	36.30
Dispatch	28.30	34.60	34.20	34.70	34.40
Route Supervisor	48.20	58.80	58.30	59.10	58.60
Operations Manager	32.00	39.00	38.70	39.40	38.80
TOTAL Headcount	**959.40**	**1,170.40**	**1,157.50**	**1,179.30**	**1,163.80**
Total Headcount Increase (from Baseline)	-	211.00	198.10	219.90	204.40
Equipment Needs					
Collection Vehicle - Front End Loader	616.10	745.50	729.00	773.10	753.30
Collection Vehicle - Roll-off	228.00	253.40	263.50	229.30	240.70
Container Delivery Vehicle	28.70	36.00	35.20	37.20	36.30
Supervisor Vehicle	80.20	97.80	97.00	98.50	97.40
Collection Bins (1 - 8 CY)	165,132	258,467	253,994	250,391	246,501
Collection Drop Boxes (10 - 50 CY)	5,677	6,330	6,539	5,703	5,985

Figure 5-15. Operational Demand Summary – Northern California A (Rural)

	Northern California A (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	39.00	54.00	53.00	59.60	59.40
Pool Driver	6.80	8.90	8.70	9.70	9.70
Container Delivery	1.70	2.50	2.50	2.90	3.00
Dispatch	2.10	2.90	2.80	3.10	3.00
Route Supervisor	3.10	4.30	4.20	4.60	4.70
Operations Manager	2.40	3.30	3.30	3.50	3.60
TOTAL Headcount	55.10	75.90	74.50	83.40	83.40
Total Headcount Increase (from Baseline)	-	20.80	19.40	28.30	28.30
Equipment Needs					
Collection Vehicle - Front End Loader	32.90	51.40	50.20	60.10	58.90
Collection Vehicle - Roll-off	16.50	18.00	18.20	16.00	17.30
Container Delivery Vehicle	1.70	2.50	2.50	2.90	3.00
Supervisor Vehicle	5.50	7.60	7.50	8.10	8.30
Collection Bins (1 - 8 CY)	7,429	13,651	13,518	14,029	13,895
Collection Drop Boxes (10 - 50 CY)	352	388	389	347	350

Figure 5-16. Operational Demand Summary – Northern California B (Urban)

	Northern California B (Urban)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	319.00	423.00	418.00	468.00	461.00
Pool Driver	56.00	60.50	59.70	66.90	65.90
Container Delivery	14.30	19.90	19.70	23.30	22.90
Dispatch	16.90	22.40	22.20	24.90	24.40
Route Supervisor	24.90	33.00	32.70	36.60	36.00
Operations Manager	19.00	25.30	24.90	27.90	27.50
TOTAL Headcount	**450.10**	**584.10**	**577.20**	**647.60**	**637.70**
Total Headcount Increase (from Baseline)	-	134.00	127.10	197.50	187.60
Equipment Needs					
Collection Vehicle - Front End Loader	278.60	368.90	363.30	431.10	421.10
Collection Vehicle - Roll-off	106.90	118.60	119.00	104.30	107.30
Container Delivery Vehicle	14.30	19.90	19.70	23.30	22.90
Supervisor Vehicle	43.90	58.30	57.60	64.50	63.50
Collection Bins (1 - 8 CY)	62,978	112,512	111,199	114,134	112,921
Collection Drop Boxes (10 - 50 CY)	2,380	2,626	2,644	2,344	2,379

Figure 5-17. Operational Demand Summary – Northern California B (Rural)

	Northern California B (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	180.00	226.00	223.00	288.00	281.00
Pool Driver	37.20	37.10	36.70	47.40	46.10
Container Delivery	15.70	20.40	20.10	28.00	27.20
Dispatch	12.90	16.20	15.90	20.50	20.00
Route Supervisor	16.70	21.00	20.80	26.80	26.10
Operations Manager	21.40	26.90	26.50	34.40	33.50
TOTAL Headcount	**283.90**	**347.60**	**343.00**	**445.10**	**433.90**
Total Headcount Increase (from Baseline)	-	63.70	59.10	161.20	150.00
Equipment Needs					
Collection Vehicle - Front End Loader	165.30	218.10	214.50	299.00	290.50
Collection Vehicle - Roll-off	64.50	72.00	72.20	66.00	66.20
Container Delivery Vehicle	15.70	20.40	20.10	28.00	27.20
Supervisor Vehicle	38.10	47.90	47.30	61.20	59.60
Collection Bins (1 - 8 CY)	42,799	73,070	72,017	79,116	77,750
Collection Drop Boxes (10 - 50 CY)	1,306	1,453	1,456.40	1,294.60	1,306

Figure 5-18. Operational Demand Summary – Southern California A (Urban)

	Southern California A				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	2,209.00	2,759.00	2,716.00	2,872.00	2,822.00
Pool Driver	320.80	269.00	265.70	280.10	275.90
Container Delivery	88.20	96.40	93.90	104.20	101.10
Dispatch	87.20	92.30	91.10	95.90	94.60
Route Supervisor	148.30	151.20	149.40	157.50	155.10
Operations Manager	98.60	106.00	104.70	110.40	108.90
TOTAL Headcount	**2,952.10**	**3,473.90**	**3,420.80**	**3,620.10**	**3,557.60**
Total Headcount Increase (from Baseline)	-	521.80	468.70	668.00	605.50
Equipment Needs					
Collection Vehicle - Front End Loader	1,896.50	2,364.70	2,302.80	2,554.60	2,476.20
Collection Vehicle - Roll-off	700.50	782.80	810.70	708.10	744.80
Container Delivery Vehicle	88.20	96.40	93.90	104.20	101.10
Supervisor Vehicle	246.90	257.20	254.10	267.90	264.00
Collection Bins (1 - 8 CY)	448,627	745,369	727,855	734,210	717,717
Collection Drop Boxes (10 - 50 CY)	17,465	19,478	20,178	17,641	18,574

Figure 5-19. Operational Demand Summary – Southern California B (Urban)

	Southern California B (Urban)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	166.00	215.00	213.00	242.00	238.00
Pool Driver	29.10	30.70	30.40	34.40	33.90
Container Delivery	7.40	10.10	10.00	12.00	11.80
Dispatch	8.80	11.40	11.30	12.80	12.70
Route Supervisor	13.00	16.80	16.70	18.80	18.50
Operations Manager	9.90	12.90	12.70	14.50	14.30
TOTAL Headcount	**234.20**	**296.90**	**294.10**	**334.50**	**329.20**
Total Headcount Increase (from Baseline)	-	62.70	59.90	100.30	95.00
Equipment Needs					
Collection Vehicle - Front End Loader	144.60	186.70	184.50	222.30	216.60
Collection Vehicle - Roll-off	56.10	61.30	61.40	54.70	56.10
Container Delivery Vehicle	7.40	10.10	10.00	12.00	11.80
Supervisor Vehicle	22.90	29.70	29.40	33.30	32.80
Collection Bins (1 - 8 CY)	29,826	54,128	53,532	54,806	54,295
Collection Drop Boxes (10 - 50 CY)	1,236	1,363	1,366	1,210	1,221

Figure 5-20. Operational Demand Summary – Southern California B (Rural)

	Southern California B (Rural)				
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Staffing Levels					
Driver	22.00	26.60	26.50	35.90	34.80
Pool Driver	4.50	4.40	4.40	6.00	5.70
Container Delivery	2.00	2.50	2.50	3.60	3.20
Dispatch	1.60	1.90	1.90	2.50	2.40
Route Supervisor	2.10	2.60	2.50	3.30	3.20
Operations Manager	2.60	3.20	3.20	4.30	4.10
TOTAL Headcount	**34.80**	**41.20**	**41.00**	**55.60**	**53.40**
Total Headcount Increase (from Baseline)	-	6.40	6.20	20.80	18.60
Equipment Needs					
Collection Vehicle - Front End Loader	20.50	25.70	25.70	38.00	35.60
Collection Vehicle - Roll-off	7.50	8.40	8.50	7.40	8.90
Container Delivery Vehicle	2.00	2.50	2.50	3.60	3.20
Supervisor Vehicle	4.70	5.80	5.70	7.60	7.30
Collection Bins (1 - 8 CY)	5,738	9,659	9,531	10,563	10,384
Collection Drop Boxes (10 - 50 CY)	160	178	178	157	159

KEY COST FACTORS

In order to calculate labor and equipment needs by both region and scenario, values were assumed for the following key cost factors:

- Operating days per year;
- Operating hours per day;
- Yards per lift or tons per pull;
- Lifts or pulls per driver hour; and,
- Average collection frequency.

Specific data for each of these key variables was gathered for each of the regions in the study. Where specific regional data was not available for these key variables, data from similar regions was applied. As detailed in the "input" section of the cost model provided to CalRecycle, the model assumes urbanized regions will have relatively higher productivity to reflect the relatively higher collection densities that exist in those regions.

Labor Costs

Using benefits information, estimated hourly rates, and staffing/supervisory ratios gathered through the data collection process, and payroll tax information from the California Department of Finance, the model calculates the labor collection costs. The operational demands, discussed above, were used to determine the staffing requirements by both region and scenario.

COSTS INCLUDED IN "LABOR"

The following "labor" costs are calculated based on the key variables listed below: regular, overtime, holiday, vacation, and sick leave wages, workers compensation premiums and claims, health and welfare benefits, bonuses, payroll taxes, uniform benefits and pension/retirement benefits.

KEY COST FACTORS

In order to calculate "labor" costs for the collection system by both region and scenario, the following values were assumed for the following key cost factors:

- Operating days per year;
- Hourly Wages and Salaries;
- Bonuses;
- Work Rules (i.e., overtime premium, driver hours per day, support staff hours per day, paid time off days per year);
- Staffing ratios (i.e., number of routes per container delivery driver, dispatcher, route supervisor, operations manager, and pool drivers);
- Uniform costs per employee per year; and,
- Payroll Tax Rates.

Specific data for each of these key variables was gathered for each of the regions in the study (including, for example, collective bargaining agreements). Where specific regional data was not available for these key variables, data from similar regions was applied.

Fuel Costs

COSTS INCLUDED IN "FUEL"

The "fuel" costs include only the cost of low sulfur number two diesel. This cost is calculated using the results of the operational demand analysis to provide the number of route hours per year and the key variables described below.

KEY COST FACTORS

In order to calculate "fuel" costs for the collection system by both region and scenario, the following key cost factors were identified:

- Fuel gallons consumed per hour; and,
- Fuel cost per gallon.

These key variables do not fluctuate significantly from one region to another within the State. As such, these values were held constant across all regions.

Potential Impact of Low Carbon Fuel Standard/Alternative Fuel Vehicles

It was not within the scope of this study to identify the potential cost impacts of the low carbon fuel standard or the increasing use of alternative fuel vehicles. However, these considerations may have a significant impact on the collection fuel costs calculated.

Repair & Maintenance Costs

Costs Included in "Repair & Maintenance"

"Repair & Maintenance" costs are calculated using the average annual cost per route for repairs and maintenance of containers and route vehicles (i.e., annual vehicle and container shop costs divided by number of routes). These costs include all shop-related labor, tools, supplies, tires, fluids, replacement parts, and any major or minor repair work. These costs also include all vehicle-specific taxes and insurance costs.

Key Cost Factors

Specific data for maintenance costs per route were gathered for each of the regions in the study. Different values were assumed for the per-route annual cost of maintaining front-end-loading vehicles and containers from roll-off vehicles and containers. Where specific regional data was not available for these key variables, data from similar regions were applied.

Depreciation Costs

Costs Included in "Depreciation"

"Depreciation" costs in the collection system include the annual straight-line depreciation of new and existing containers, route vehicles, supervisor vehicles, and container delivery vehicles. When calculating depreciation expenses, vehicles and containers that are no longer needed for collection of solid waste are assumed to be transferrable to the collection of recyclables, organics, or C&D.

Key Cost Factors

In order to calculate "depreciation" expense for the collection system by both region and scenario, assumptions were made based on the data gathered related to the following key cost factors:

- New Front End Loader Collection Vehicle Cost;
- New Roll-Off Collection Vehicle Cost;
- New Container Delivery Vehicle Cost;
- New Supervisor Vehicle Cost;
- New Front-Loader Bin Cost;
- New Drop-Box Cost;
- Average age of existing vehicles and containers;
- Useful lives of vehicles and containers; and,

- Spare vehicle and container ratios.

Specific data for each of these key variables were gathered for each of the regions in the study. Where specific regional data was not available for these key cost factors, data from similar regions was applied. New equipment costs were assumed to be the same across all regions with the exception of container delivery vehicles, where it is likely that smaller, less expensive types of vehicles would be used in the rural regions.

Other Costs

COSTS INCLUDED IN "OTHER"

The following "other" costs categories are included in the collection system costs: interest expense, jurisdiction fees (e.g., franchise fees), overhead costs, and profit. Overhead costs are assumed to include all of the following:

- Management,
- Administrative building and truck parking lease or depreciation costs,
- Customer service,
- Billing and collections,
- Insurance and performance bonds,
- Training and safety programs,
- Corporate overhead charges, and
- All other selling, general and administrative costs.

KEY COST FACTORS

In order to calculate "other" costs incurred by the collection system by both region and scenario, the following assumptions were made:

- Interest expense was calculated assuming five year financing of any new equipment (as determined in the operational demand analysis) at an interest rate of seven percent;
- Overhead (expressed as a percentage of all other operating expenses); and,
- City Fees (expressed as a percentage of gross revenue).

Specific data for each of these key variables were gathered for each of the regions in the study. Where specific regional data was not available for these key cost factors, data from similar regions were applied.

Processing Analysis

Processing Findings by Region and by Scenario

Figures 5-21 through 5-24 below present a summary of the results of the processing analysis for each scenario. Each figure presents, for each region and statewide, the cost, by cost category, of processing the recovered tons. The subtotal costs are divided by the tons of material that are processed in the region to calculate an average per ton processing cost. Depending on the scenario, the cost per ton represents the cost of processing for each type of processing used in that scenario. For example, Scenario 1 processing costs represent a weighted averaging of single stream processing and source separated processing. By contrast, Scenario 4 processing costs represent a weighted average of composting, single stream, mixed C&D, and source separated processing. The cost per ton assumption for each cost category for each processing strategy is presented later in this section.

The processing costs in Scenario 1 are the highest as they assume single-stream processing as the primary strategy while some material (approximately 80% of the self-haul) is assumed to be delivered source separated and require minimal processing. To the extent that a hauler or community is effective in developing single material collection programs (e.g., cardboard only), these costs can be reduced by delivering materials that require less processing.

Figure 5-21. Scenario 1 Processing Cost Summary by Region

	Scenario 1 - Traditional Recyclable Materials			
Processing Costs	**Northern California A (Urban)**	**Northern California A (Rural)**	**Northern California B (Urban)**	**Northern California B (Rural)**
Labor-Related Costs	$ 12,947,786	$ 567,309	$ 2,804,024	$ 1,730,959
Energy Costs	$ 573,477	$ 28,539	$ 225,055	$ 131,410
Repairs & Maintenance	$ 7,001,342	$ 292,919	$ 1,520,575	$ 804,426
Direct Depreciation	$ 2,537,374	$ 98,689	$ 413,824	$ 220,945
Other Costs	$ 3,493,784	$ 177,494	$ 1,032,933	$ 567,177
Annual Processing Subtotal	**$ 26,553,763**	**$ 1,164,950**	**$ 5,996,412**	**$ 3,454,917**
Processing Cost per Ton	$ 86.72	$ 77.16	$ 55.60	$ 71.42
Processing Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor-Related Costs	$ 34,090,979	$ 1,603,950	$ 341,050	$ 54,086,057
Energy Costs	$ 1,708,821	$ 118,916	$ 16,313	$ 2,802,529
Repairs & Maintenance	$ 17,615,703	$ 805,804	$ 100,183	$ 28,140,953
Direct Depreciation	$ 8,764,717	$ 217,382	$ 27,213	$ 12,280,145
Other Costs	$ 10,512,109	$ 653,429	$ 70,431	$ 16,507,357
Annual Processing Subtotal	**$ 72,692,329**	**$ 3,399,481**	**$ 555,189**	**$ 113,817,041**
Processing Cost per Ton	$ 77.75	$ 57.09	$ 91.68	$ 77.00

Processing costs in scenario 2 are reduced slightly relative to scenario 1 due to the addition of C&D. Commercially-hauled C&D is assumed to be collected and processed as mixed C&D, while approximately 80% of the self-hauled C&D is assumed to be source separated and require minimal processing and handling. To the extent that C&D can be source separated at the job site, the cost of mixed C&D processing can be reduced.

Figure 5-22. Scenario 2 Processing Cost Summary by Region

Processing Costs	Scenario 2 - Traditional Recyclable and C&D Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor-Related Costs	$ 12,876,425	$ 524,966	$ 2,621,199	$ 1,601,136
Energy Costs	$ 612,068	$ 27,024	$ 212,749	$ 122,764
Repairs & Maintenance	$ 6,711,614	$ 268,940	$ 1,405,348	$ 739,604
Direct Depreciation	$ 2,611,570	$ 92,978	$ 402,059	$ 211,475
Other Costs	$ 3,566,794	$ 165,469	$ 968,405	$ 528,112
Annual Processing Subtotal	**$ 26,378,471**	**$ 1,079,377**	**$ 5,609,760**	**$ 3,203,091**
Processing Cost per Ton	$ 77.41	$ 73.37	$ 53.77	$ 67.79
Processing Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor-Related Costs	$ 33,596,335	$ 1,472,771	$ 310,589	$ 53,003,421
Energy Costs	$ 1,940,300	$ 110,409	$ 15,061	$ 3,040,374
Repairs & Maintenance	$ 16,992,663	$ 735,922	$ 91,437	$ 26,945,526
Direct Depreciation	$ 8,926,565	$ 204,673	$ 25,473	$ 12,474,794
Other Costs	$ 10,560,310	$ 598,463	$ 64,838	$ 16,452,393
Annual Processing Subtotal	**$ 72,016,173**	**$ 3,122,238**	**$ 507,398**	**$ 111,916,508**
Processing Cost per Ton	$ 63.24	$ 53.36	$ 85.75	$ 65.44

Processing costs in scenario 3 are reduced relative to scenarios 1 and 2 due to the addition of a significant quantity of organic materials that are assumed to be composted. This reduction occurs because the cost of processing organic material into compost is significantly less than the cost to sort single-stream recyclables or mixed C&D. To the extent that pending local and statewide air regulations require advanced control technologies (e.g., static aerated piles, in-vessel composting, etc.) at compost facilities in the future, these costs may increase significantly.

Figure 5-23. Scenario 3 Processing Cost Summary by Region

Processing Costs	Scenario 3 - Traditional Recyclable and Organic Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor-Related Costs	$ 14,666,188	$ 646,437	$ 3,410,164	$ 1,910,207
Energy Costs	$ 1,132,409	$ 51,659	$ 336,670	$ 173,625
Repairs & Maintenance	$ 7,874,009	$ 340,812	$ 1,863,056	$ 902,700
Direct Depreciation	$ 3,189,022	$ 132,765	$ 673,653	$ 324,796
Other Costs	$ 7,258,058	$ 344,353	$ 2,086,473	$ 1,013,740
Annual Processing Subtotal	**$ 34,119,686**	**$ 1,516,027**	**$ 8,370,015**	**$ 4,325,069**
Processing Cost per Ton	$ 47.43	$ 43.52	$ 33.39	$ 37.62
Processing Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor-Related Costs	$ 40,502,957	$ 1,978,090	$ 343,887	$ 63,457,930
Energy Costs	$ 3,502,520	$ 190,283	$ 22,193	$ 5,409,359
Repairs & Maintenance	$ 20,853,864	$ 1,066,079	$ 116,022	$ 33,016,543
Direct Depreciation	$ 10,516,249	$ 383,779	$ 41,612	$ 15,261,877
Other Costs	$ 22,093,988	$ 1,277,057	$ 130,553	$ 34,204,222
Annual Processing Subtotal	**$ 97,469,578**	**$ 4,895,289**	**$ 654,268**	**$ 151,349,931**
Processing Cost per Ton	$ 45.32	$ 34.54	$ 44.30	$ 44.16

Scenario 4 represents the lowest total processing cost of all of the scenarios contemplated. This low processing cost results from significantly reducing the percentage of the total recovery stream that is processed by single-stream processing and maximizing the number of tons delivered by self-haulers that is already source-separated and requires little processing.

Figure 5-24. Scenario 4 Processing Cost Summary by Region

Processing Costs	Scenario 4 - All Tons Excluding Solid Waste			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor-Related Costs	$ 14,584,630	$ 604,317	$ 3,208,792	$ 1,786,485
Energy Costs	$ 1,131,383	$ 48,506	$ 317,482	$ 162,997
Repairs & Maintenance	$ 7,602,448	$ 316,582	$ 1,738,029	$ 839,972
Direct Depreciation	$ 3,231,272	$ 125,254	$ 643,698	$ 308,748
Other Costs	$ 7,082,032	$ 320,580	$ 1,945,937	$ 944,401
Annual Processing Subtotal	**$ 33,631,765**	**$ 1,415,239**	**$ 7,853,939**	**$ 4,042,603**
Processing Cost per Ton	$ 46.80	$ 43.06	$ 33.33	$ 37.27
Processing Costs	Southern California A	Southern California B (Urban)	Southern California B (Rural)	State of California
Labor-Related Costs	$ 40,036,010	$ 1,838,217	$ 317,945	$ 62,376,397
Energy Costs	$ 3,627,358	$ 177,493	$ 20,673	$ 5,485,892
Repairs & Maintenance	$ 20,273,518	$ 986,058	$ 107,352	$ 31,863,959
Direct Depreciation	$ 10,663,113	$ 360,165	$ 39,028	$ 15,371,276
Other Costs	$ 21,528,906	$ 1,179,891	$ 120,933	$ 33,122,679
Annual Processing Subtotal	**$ 96,128,904**	**$ 4,541,824**	**$ 605,930**	**$ 148,220,204**
Processing Cost per Ton	$ 42.76	$ 33.88	$ 43.51	$ 42.45

Summary of Existing Infrastructure

As part of the data gathering process, processors and composters were asked how much available capacity they had at their facilities and whether or not they could expand their capacity significantly without investing in new facilities or equipment (e.g., by adding a shift). With only five responses from processors and composters, this represents a limited sampling of the processors in the State, the information from the respondents provides some anecdotal support for the following conclusions.

Single-stream processors felt that there was sufficient infrastructure to process the additional tons resulting from the proposed regulation and expressed their belief that they could extend their capacity by 50% to 100%.

C&D processing capacity is well-established in most regions, though some rural areas do not have the volume of material needed to make mixed C&D processing cost-effective. In these regions it is common to have lumber, metal, and inert (i.e., concrete, asphalt, dirt, rock, etc.) recycling areas at local landfills. C&D processors felt that sufficient processing capacity was available for these material types on a statewide basis, particularly in light of the available capacity resulting from declines in C&D volumes since 2008.

While organics processing infrastructure in the Bay Area and Central Valley is significant and expanding, it is not sufficient to accommodate the additional 2.0 million to 2.2 million tons of organic material contemplated by Scenarios 3 and 4. It is assumed that additional organics processing capacity will have to be developed and that, due to emerging regulatory requirements, much of the future capacity that will be developed will include advanced emissions controls (e.g. aerated static piles, in-vessel composting, anaerobic digestion, etc.). Cost data for organics processing strategies including these advanced emissions controls was provided by the industry. Based on the data provided, these advanced emissions control strategies would require an average tipping fee of $39.32 per ton. Depending on the region, this would increase the organics processing costs by $11.73 to $19.28 per ton. Because it is unclear when regulations would require these control technologies or when significant processing capacity of this type will be available, the increased processing cost has not been reflected in these estimates. CalRecycle is currently conducting a study of the current and available infrastructure of processing facilities throughout the state. The results of that project should provide more detail regarding the adequacy of the existing infrastructure in the state.

General Processing Considerations

PROCESSING STRATEGIES/TECHNOLOGIES USED

This model assumes recovered materials will be processed using one of the following processing types:

- "Source Separated" processing, which assumes materials will be separated by the self-hauler at the processing facility or landfill-based recycling area and will require minimal processing and handling (e.g., grinding, baling, etc.);
- Organics processing, which assumes that organic materials are delivered to a traditional wind-row composting facility where material will be ground and require minimal pre-screening;
- Mixed C&D processing, which assumes that materials are not separated at the construction job site, but rather commingled into one container and delivered for separation to a mixed C&D MRF; and,
- Single-stream processing, which assumes one collection container is utilized for all recyclables and sorted at the MRF.

The model also assumes green waste collected at mixed C&D MRFs will need to be processed twice: once through mixed C&D processing, and again through the organics processing.

DEVELOPMENT OF FUTURE STRATEGIES/TECHNOLOGIES

The processing strategies used to estimate costs, savings, and net costs were based on conventional processing methods currently in place. Any changes to the current technology available may affect the results presented in each scenario. For example, the cost estimates do not assume the use of anaerobic digestion, a change to either of these assumptions would significantly affect the results of the processing cost modeling.

Assumed Processing Costs

Figures 5-25 through 5-28 below present the assumed costs per recovered ton for processing using each of the processing strategies described above. Specific data for each of these key variables were gathered for each of the regions in the study. Where specific regional data were not available for these key variables, data from similar regions were applied.

Figure 5-25. Single Stream Processing Cost Assumptions by Region

Single-Stream Processing	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)
Labor Cost per Ton	$ 44.36	$ 38.70	$ 26.48	$ 36.94	$ 38.70	$ 28.64	$ 58.56
Energy Cost per Ton	$ 1.93	$ 1.93	$ 2.12	$ 2.80	$ 1.93	$ 2.12	$ 2.80
Repair & Maintenance Cost per Ton	$ 24.09	$ 20.03	$ 14.39	$ 17.20	$ 20.03	$ 14.39	$ 17.20
Depreciation Cost per Ton	$ 8.65	$ 6.70	$ 3.88	$ 4.67	$ 9.94	$ 3.88	$ 4.67
Other Cost per Ton	$ 11.92	$ 12.09	$ 9.75	$ 12.09	$ 11.92	$ 11.67	$ 12.09
Total Cost per Ton	**$ 90.95**	**$ 79.44**	**$ 56.62**	**$ 73.70**	**$ 82.52**	**$ 60.70**	**$ 95.32**

Figure 5-26. Mixed C&D Processing Cost Assumptions by Region

Mixed C&D Processing	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)
Labor Cost per Ton	$ 27.58	$ 23.56	$ 21.08	$ 23.06	$ 20.29	$ 20.29	$ 26.40
Energy Cost per Ton	$ 1.92	$ 1.92	$ 2.27	$ 2.52	$ 2.83	$ 2.27	$ 2.52
Repair & Maintenance Cost per Ton	$ 9.28	$ 9.10	$ 8.26	$ 8.99	$ 8.05	$ 7.69	$ 8.99
Depreciation Cost per Ton	$ 7.31	$ 6.58	$ 6.21	$ 6.35	$ 7.31	$ 5.94	$ 6.35
Other Cost per Ton	$ 9.39	$ 9.74	$ 8.55	$ 9.74	$ 7.65	$ 7.31	$ 9.74
Total Cost per Ton	**$ 55.49**	**$ 50.90**	**$ 46.37**	**$ 50.67**	**$ 46.13**	**$ 43.49**	**$ 54.01**

Figure 5-27. Organics Processing Cost Assumptions by Region

Composting	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)
Labor Cost per Ton	$ 8.80	$ 8.21	$ 6.94	$ 6.65	$ 9.19	$ 7.22	$ 6.76
Energy Cost per Ton	$ 1.42	$ 1.26	$ 0.94	$ 0.88	$ 1.52	$ 1.00	$ 0.91
Repair & Maintenance Cost per Ton	$ 4.64	$ 4.55	$ 3.85	$ 3.29	$ 4.70	$ 4.40	$ 3.51
Depreciation Cost per Ton	$ 2.39	$ 2.33	$ 2.07	$ 1.92	$ 2.44	$ 2.22	$ 1.98
Other Cost per Ton	$ 9.39	$ 8.87	$ 7.65	$ 7.31	$ 9.74	$ 7.99	$ 7.44
Total Cost per Ton	**$ 26.64**	**$ 25.21**	**$ 21.44**	**$ 20.04**	**$ 27.59**	**$ 22.84**	**$ 20.60**

Figure 5-28. Source Separated Processing Cost Assumptions by Region

Source Separated Processing	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)
Labor Cost per Ton	$ 8.80	$ 8.21	$ 6.94	$ 6.65	$ 7.69	$ 7.22	$ 6.76
Energy Cost per Ton	$ 0.94	$ 0.84	$ 0.63	$ 0.59	$ 0.76	$ 0.67	$ 0.60
Repair & Maintenance Cost per Ton	$ 3.09	$ 3.03	$ 2.56	$ 2.19	$ 2.75	$ 2.94	$ 2.34
Depreciation Cost per Ton	$ 2.39	$ 2.33	$ 2.07	$ 1.92	$ 2.19	$ 2.22	$ 1.98
Other Cost per Ton	$ 3.13	$ 2.96	$ 2.55	$ 2.44	$ 2.78	$ 2.66	$ 2.48
Total Cost per Ton	**$ 18.36**	**$ 17.37**	**$ 14.75**	**$ 13.78**	**$ 16.17**	**$ 15.71**	**$ 14.17**

Transportation Analysis

Transportation Findings by Region and by Scenario

Figures 5-29 through 5-32 below present a summary of the results of the transportation analysis for each scenario. Each figure presents, for each region and statewide, the cost, by cost category, of transporting the recovered tons to either domestic markets or to the nearest port for export. The subtotal costs are divided by the tons of material that are recovered in the region. The cost per ton assumption for each cost category for each of five material destinations is presented later in this section.

Figure 5-29. Scenario 1 Transportation Cost Summary by Region

	Scenario 1 - Traditional Recyclable Materials			
Transportation Costs	**Northern California A (Urban)**	**Northern California A (Rural)**	**Northern California B (Urban)**	**Northern California B (Rural)**
Labor, Equipment, and Other Costs	$ 3,074,616	$ 198,075	$ 2,193,176	$ 1,103,515
Fuel Costs	$ 1,654,055	$ 38,328	$ 393,374	$ 207,807
Annual Transportation Subtotal	**$ 4,728,671**	**$ 236,403**	**$ 2,586,550**	**$ 1,311,322**
Transportation Cost per Ton	$ 15.44	$ 15.66	$ 23.98	$ 27.11
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor, Equipment, and Other Costs	$ 8,276,429	$ 1,151,625	$ 170,747	$ 16,168,183
Fuel Costs	$ 3,262,432	$ 202,134	$ 34,343	$ 5,792,474
Annual Transportation Subtotal	**$ 11,538,862**	**$ 1,353,759**	**$ 205,090**	**$ 21,960,657**
Transportation Cost per Ton	$ 12.34	$ 22.73	$ 33.87	$ 14.86

Figure 5-30. Scenario 2 Transportation Cost Summary by Region

Transportation Costs	Scenario 2 - Traditional Recyclable and C&D Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor, Equipment, and Other Costs	$ 3,405,446	$ 190,828	$ 2,066,088	$ 1,046,185
Fuel Costs	$ 1,818,929	$ 36,573	$ 366,394	$ 194,791
Annual Transportation Subtotal	**$ 5,224,374**	**$ 227,400**	**$ 2,432,481**	**$ 1,240,977**
Transportation Cost per Ton	$ 15.33	$ 15.46	$ 23.32	$ 26.26
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor, Equipment, and Other Costs	$ 10,517,846	$ 1,112,451	$ 163,486	$ 18,502,329
Fuel Costs	$ 4,641,759	$ 193,759	$ 32,700	$ 7,284,905
Annual Transportation Subtotal	**$ 15,159,606**	**$ 1,306,210**	**$ 196,186**	**$ 25,787,234**
Transportation Cost per Ton	$ 13.31	$ 22.33	$ 33.16	$ 15.08

Figure 5-31. Scenario 3 Transportation Cost Summary by Region

Transportation Costs	Scenario 3 - Traditional Recyclable and Organic Materials			
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)
Labor, Equipment, and Other Costs	$ 5,879,656	$ 364,597	$ 2,974,478	$ 1,587,878
Fuel Costs	$ 1,995,496	$ 55,587	$ 366,242	$ 227,052
Annual Transportation Subtotal	**$ 7,875,152**	**$ 420,184**	**$ 3,340,720**	**$ 1,814,931**
Transportation Cost per Ton	$ 10.95	$ 12.06	$ 13.33	$ 15.79
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor, Equipment, and Other Costs	$ 17,259,688	$ 1,778,922	$ 211,166	$ 30,056,386
Fuel Costs	$ 5,449,492	$ 236,710	$ 31,011	$ 8,361,590
Annual Transportation Subtotal	**$ 22,709,180**	**$ 2,015,632**	**$ 242,177**	**$ 38,417,975**
Transportation Cost per Ton	$ 10.56	$ 14.22	$ 16.40	$ 11.21

Figure 5-32. Scenario 4 Transportation Cost Summary by Region

	Scenario 4 - All Tons Excluding Solid Waste			
Transportation Costs	**Northern California A (Urban)**	**Northern California A (Rural)**	**Northern California B (Urban)**	**Northern California B (Rural)**
Labor, Equipment, and Other Costs	$ 5,953,733	$ 344,482	$ 2,798,282	$ 1,497,797
Fuel Costs	$ 2,106,192	$ 52,620	$ 344,947	$ 214,114
Annual Transportation Subtotal	**$ 8,059,925**	**$ 397,102**	**$ 3,143,229**	**$ 1,711,911**
Transportation Cost per Ton	$ 11.22	$ 12.08	$ 13.34	$ 15.78
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Labor, Equipment, and Other Costs	$ 18,586,972	$ 1,692,506	$ 201,348	$ 31,075,120
Fuel Costs	$ 6,461,977	$ 226,410	$ 29,822	$ 9,436,082
Annual Transportation Subtotal	**$ 25,048,949**	**$ 1,918,916**	**$ 231,169**	**$ 40,511,202**
Transportation Cost per Ton	$ 11.14	$ 14.31	$ 16.60	$ 11.60

General Transportation Considerations

EXISTENCE OF TRANSPORTATION INFRASTRUCTURE

For the purposes of this study, transportation infrastructure is assumed to be sufficient to accommodate the additional volume of materials that will need to be delivered to markets as a result of the proposed regulation. This is a reasonable assumption, particularly given the general decline in economic conditions and reduced consumer demand for products which would logically result in available trucking infrastructure.

TRANSPORTATION STRATEGIES/TECHNOLOGIES USED

Currently, one of two methods is utilized to haul the recyclable commodities to the nearest port: 1) the processor may hire a third party to haul the materials, or, 2) the processor may haul their own materials. Typically, processors who have long haul trucks in their fleet are either operating under a union contract that prevents them from outsourcing this activity or they have collateral business activities that involve long-haul trucking.

DEVELOPMENT OF FUTURE STRATEGIES/TECHNOLOGIES

The transportation strategies used to estimate costs, savings, and net costs were based on conventional transportation methods currently in place. Any changes to the current technology available may affect the results presented in each scenario. For example, the model does not assume the use of rail-haul, which may affect the results of the transportation cost analysis.

Assumed Transportation Costs

Figures 5-33 through 5-36 below present the assumed costs per ton for transportation of four different groupings of materials (based on the destination market of the material). Specific data for each of these key cost factors were gathered for each of the regions in the study. Where specific regional data were not available for these key variables, data from similar regions were applied.

The first grouping of materials is “export commodities”. These include the various grades of paper, cardboard, plastics, and metals. The cost illustrated below is the average (weighted by the tons of material from each County within each region) per ton cost of delivering the materials from the region to the nearest port (i.e., the Port of Oakland or the Port of Los Angeles/Long Beach).

Figure 5-33. Export Commodities Transportation Cost Assumptions by Region

	Export Commodities			
Transportation Costs	**Northern California A (Urban)**	**Northern California A (Rural)**	**Northern California B (Urban)**	**Northern California B (Rural)**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 5.33	$ 2.54	$ 3.84	$ 4.40
Haul Cost	$ 3.03	$ 6.17	$ 14.12	$ 16.27
Total Transportation Cost per Ton	**$ 15.32**	**$ 15.66**	**$ 24.91**	**$ 27.63**
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 3.33	$ 3.45	$ 5.83	$ 3.81
Haul Cost	$ 1.79	$ 12.60	$ 21.88	$ 3.99
Total Transportation Cost per Ton	**$ 12.08**	**$ 23.00**	**$ 34.67**	**$ 14.76**

The second grouping of materials is glass. Glass is generally recovered regionally with facilities in the Bay Area, Central Valley, and in the Mexican border town of Mexicali. The costs presented below are the assumed costs to deliver the various grades of glass to the nearest regional recycler.

Figure 5-34. Glass Transportation Cost Assumptions by Region

Transportation Costs	Glass: Northern California A (Urban)	Glass: Northern California A (Rural)	Glass: Northern California B (Urban)	Glass: Northern California B (Rural)
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 6.35	$ 2.53	$ 1.39	$ 3.08
Haul Cost	$ 3.71	$ 6.13	$ 4.48	$ 11.13
Total Transportation Cost per Ton	**$ 17.02**	**$ 15.61**	**$ 12.83**	**$ 21.16**
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 5.53	$ 2.75	$ 3.97	$ 5.35
Haul Cost	$ 3.32	$ 9.86	$ 14.59	$ 3.70
Total Transportation Cost per Ton	**$ 15.81**	**$ 19.57**	**$ 25.52**	**$ 16.00**

The third grouping of materials is wood waste. Wood waste includes dimensional lumber, pallets, and other non-treated wood waste. Wood waste is recovered into mulch product or used as biomass fuel on a regional basis with a relatively high number of local outlets available within each region. Materials are assumed, for the purposes of this analysis, to flow to the nearest biomass to energy facility, however if wood waste is used in mulch products and sold locally, the resulting transportation costs may be lower than those presented here.

Figure 5-35. Wood Waste Transportation Cost Assumptions by Region

Transportation Costs	Wood Waste: Northern California A (Urban)	Wood Waste: Northern California A (Rural)	Wood Waste: Northern California B (Urban)	Wood Waste: Northern California B (Rural)
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 4.93	$ 1.47	$ 0.61	$ 0.81
Haul Cost	$ 2.73	$ 3.15	$ 1.46	$ 2.34
Total Transportation Cost per Ton	**$ 14.62**	**$ 11.58**	**$ 9.02**	**$ 10.11**
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 7.06	$ 1.82	$ 2.73	$ 6.40
Haul Cost	$ 4.23	$ 6.19	$ 9.70	$ 3.93
Total Transportation Cost per Ton	**$ 18.25**	**$ 14.97**	**$ 19.38**	**$ 17.28**

The final grouping of materials is compostables. Organics includes green waste, food waste, and compostable paper. Organics are generally processed at regional compost facilities. These facilities are generally known because they are required to be permitted. However, the existing permitted capacity may be insufficient for the additional volumes contemplated by this study. For the purposes of this study, the transportation costs for compostables is based on delivery to the nearest permitted compost facility. To the extent that more compost facilities are located near the point of waste generation, the resulting transportation costs may be reduced.

Figure 5-36. Compostables Transportation Cost Assumptions by Region

	Compostables			
Transportation Costs	**Northern California A (Urban)**	**Northern California A (Rural)**	**Northern California B (Urban)**	**Northern California B (Rural)**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 1.38	$ 1.08	$ 0.28	$ 0.77
Haul Cost	$ 0.23	$ 2.07	$ 0.35	$ 2.18
Total Transportation Cost per Ton	**$ 8.57**	**$ 10.10**	**$ 7.59**	**$ 9.90**
Transportation Costs	**Southern California A**	**Southern California B (Urban)**	**Southern California B (Rural)**	**State of California**
Transport Cost per Ton				
Base Cost	$ 6.96	$ 6.96	$ 6.96	$ 6.96
Fuel Cost	$ 2.01	$ 0.78	$ 0.31	$ 1.69
Haul Cost	$ 0.62	$ 2.07	$ 0.39	$ 0.63
Total Transportation Cost per Ton	**$ 9.58**	**$ 9.80**	**$ 7.66**	**$ 9.28**

Calculation of Transportation Costs

The transportation analysis was performed assuming values for three primary cost factors for each region – base cost, fuel cost, and haul cost. The calculations were performed using data provided by a single service provider. The data provided includes the cost of trucking materials from 75 different locations around the state. HF&H believes that the cost assumptions used are lower than the cost for processors operating their own fleets; however, there is also evidence that the pricing provided was higher than spot markets for one-way trucking in recent years. Processors operating their own fleets may be subject to collective bargaining agreements, which could influence their costs.

Base costs are defined as the minimum charge for picking up the materials from the processing facility. This represents the cost of loading, unloading, queuing, and a minimum travel distance of 10 miles. Using rates obtained through the data gathering process, HF&H back calculated the base cost for pickup using the assumed tons per payload. The charge shown above is the cost per ton transported. This cost was presented uniformly in the information provided by industry, demonstrating no difference in this base cost from one region to another.

The one way distance to the domestic market or port, along with the cost components described above, and the assumed tons per payload were used to calculate the haul and fuel costs. The haul and fuel costs were then converted to a dollar per ton cost by region, using the weighted average of the cost per ton per mile and the tons recovered from each region. The total transportation system costs per region were then determined using the base cost, fuel cost and haul cost (shown above) and the county-wide tons.

The fuel and hauling cost components represent the additional cost per ton mile beyond the minimum charge. In the transportation summary figures (included in Appendices A through J), the base cost and haul cost were combined and are shown as “Labor, Equipment and Other Costs”, while fuel costs were calculated separately. “Labor, Equipment, and Other Costs” is intended to include all costs incurred by the transportation operation including any profit.

Disposal Analysis

Disposal Findings by Region and by Scenario

Figure 5-37 below presents the findings of the disposal cost modeling by region and for each scenario. The per-ton disposal costs were gathered through a survey of negotiated disposal rates for municipal and high-volume customers. Where appropriate, these disposal rates have been weighted to include the costs of transfer station and transport operations. These disposal rates include all government fees and taxes.

The annual baseline disposal cost (for all materials currently disposed in landfills) is calculated at approximately$ 1.2 billion. Depending on the program scenario considered, the savings from avoided disposal costs ranges from approximately$ 65 million to$ 153 million. This represents a 5.4% to 12.7% reduction in disposal costs.

Figure 5-37. Summary of Disposal Costs

	DISPOSAL COSTS							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A	Southern California B (Urban)	Southern California B (Rural)	State of California
Disposal Costs								
Disposal Costs per Ton	$ 43.48	$ 49.88	$ 57.22	$ 46.59	$ 42.19	$ 41.83	$ 49.53	$ 43.48
Annual Baseline Disposal	$ 236,678,053	$ 11,220,769	$ 88,783,766	$ 34,539,568	$ 784,725,189	$ 38,840,396	$ 4,515,244	$ 1,199,302,985
Scenario 1 - Annual Disposal	$ 223,366,485	$ 10,467,617	$ 82,612,502	$ 32,286,094	$ 745,281,412	$ 36,349,490	$ 4,215,340	$ 1,134,578,939
Scenario 1 - Avoided Disposal (savings)	$ (13,311,568)	$ (753,152)	$ (6,171,264)	$ (2,253,474)	$ (39,443,777)	$ (2,490,906)	$ (299,904)	$ (64,724,046)
Scenario 2 - Annual Disposal	$ 221,863,367	$ 10,486,885	$ 82,813,939	$ 32,338,282	$ 736,681,992	$ 36,392,916	$ 4,222,192	$ 1,124,799,573
Scenario 2 - Avoided Disposal (savings)	$ (14,814,686)	$ (733,884)	$ (5,969,827)	$ (2,201,286)	$ (48,043,197)	$ (2,447,480)	$ (293,052)	$ (74,503,411)
Scenario 3 - Annual Disposal	$ 205,406,357	$ 9,483,004	$ 74,440,037	$ 29,183,990	$ 693,989,427	$ 32,911,274	$ 3,783,766	$ 1,049,197,855
Scenario 3 - Avoided Disposal (savings)	$ (31,271,696)	$ (1,737,764)	$ (14,343,729)	$ (5,355,578)	$ (90,735,762)	$ (5,929,122)	$ (731,478)	$ (150,105,130)
Scenario 4 - Annual Disposal	$ 205,433,967	$ 9,581,210	$ 75,298,496	$ 29,486,358	$ 689,884,478	$ 33,232,351	$ 3,825,573	$ 1,046,742,433
Scenario 4 - Avoided Disposal (savings)	$ (31,244,086)	$ (1,639,559)	$ (13,485,270)	$ (5,053,210)	$ (94,840,711)	$ (5,608,046)	$ (689,671)	$ (152,560,552)

General Disposal Considerations

IMPACT OF MANDATORY RECYCLING REGULATION

In order to achieve the 5MMTCO2E emissions reduction target, the model assumes that a percentage of the 27,582,590 tons currently disposed in landfills will be recovered in MRFs. The regulation will reduce landfill volumes by 5.4% in scenario 1 and up to 12.7% in scenario 4. This reduction is less than the 10% to 30% reductions in disposal volumes that landfills have experienced as a result of the recent general economic decline and is assumed, therefore, to have no affect on landfill pricing. This assumption is further supported by the prevalence of long-term disposal agreements that establish pricing regardless of volume delivered. To the extent that communities, haulers, or large-volume generators have negotiated “put or pay” agreements, which require payment for delivery of a certain volume of tonnage regardless of the actual delivery of tonnage, this reduction in tonnage may result in less avoided disposal savings than illustrated here.

IMPACT OF PENDING/CONSIDERED REGULATION

The disposal strategies used to estimate costs associated with the model were based on conventional disposal methods currently in place. Any changes to the current technology available may affect the results presented in each scenario. For example, the model does not consider pending methane capture regulations or closure/post closure financial assurances (except where these costs have already been priced in to landfill tipping fees) when calculating the disposal cost for each region. To the extent that existing landfills have not sufficiently accounted for these costs currently, these pending regulations may affect the results of the cost assessment model by making the regulation more or less cost effective.

DEVELOPMENT OF FUTURE STRATEGIES/TECHNOLOGIES

This model does not assume the use of technologies to convert waste into energy or transportation fuel (e.g., mass burn, hydrolysis, pyrolysis, gasification, refuse-derived fuel, etc). To the extent that such technologies replace traditional landfills in the future, there may be an associated change to the cost of disposal.

Recyclable Commodity Value Analysis

Commodity Value Findings by Region and by Scenario

Figures 5-38 through 5-41 below summarize the annual cost savings achieved from the sale of recyclable commodities by scenario, region, and material type. The results of the commodity analysis demonstrate that traditional recycling systems result in the greatest level of commodity value and that as less valuable materials (i.e., wood waste and organics) become a larger portion of the recovered waste stream, the cost savings resulting from commodity sales decreases.

While there is evidence of significant existing in-state remanufacturing of HDPE, PET, and steel, it is unclear how much additional capacity in-state facilities may have to accept the volumes contemplated by this study. As such, the estimates assume that the various grades of paper, cardboard, metals and plastics will be sold in export markets; conversely, glass, wood waste, green waste, and compostable materials are assumed to be sold domestically. A description of the destination markets is described above in the transportation analysis.

Figure 5-38. Scenario 1 Commodity Summary

	Scenario 1 - Traditional Recyclable Materials							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Commodity Costs (Savings)								
Paper	$ (11,814,506)	$ (546,195)	$ (3,963,856)	$ (1,705,763)	$ (34,889,616)	$ (2,143,908)	$ (212,750)	$ (55,276,595)
Cardboard	$ (11,033,879)	$ (570,379)	$ (4,147,583)	$ (1,844,972)	$ (34,288,031)	$ (2,246,051)	$ (232,521)	$ (54,363,416)
Metals	$ (13,489,642)	$ (660,100)	$ (4,675,722)	$ (2,167,162)	$ (41,981,319)	$ (2,663,157)	$ (259,479)	$ (65,896,581)
Wood Waste	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Green Waste	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Compostables	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Mixed Plastics	$ (7,579,376)	$ (349,717)	$ (2,553,725)	$ (1,127,245)	$ (22,989,710)	$ (1,374,088)	$ (146,840)	$ (36,120,701)
Glass	$ (414,661)	$ (20,701)	$ (149,081)	$ (70,182)	$ (1,190,276)	$ (83,661)	$ (9,562)	$ (1,938,124)
Total Commodity Costs (Savings)	**$ (44,332,063)**	**$ (2,147,093)**	**$ (15,489,967)**	**$ (6,915,323)**	**$ (135,338,953)**	**$ (8,510,865)**	**$ (861,153)**	**$ (213,595,417)**

Figure 5-39. Scenario 2 Commodity Summary

	Scenario 2 - Traditional Recyclable and C&D Materials							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Commodity Costs (Savings)								
Paper	$ (10,610,552)	$ (490,536)	$ (3,559,921)	$ (1,531,938)	$ (31,334,199)	$ (1,925,434)	$ (191,070)	$ (49,643,649)
Cardboard	$ (10,774,388)	$ (532,230)	$ (3,832,136)	$ (1,722,988)	$ (35,298,581)	$ (2,106,813)	$ (217,125)	$ (54,484,261)
Metals	$ (14,789,040)	$ (629,167)	$ (4,483,341)	$ (2,066,422)	$ (48,617,801)	$ (2,545,014)	$ (248,132)	$ (73,378,916)
Wood Waste	$ (85,754)	$ (1,449)	$ (4,820)	$ (2,395)	$ (383,647)	$ (3,149)	$ (301)	$ (481,514)
Green Waste	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Compostables	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Mixed Plastics	$ (6,807,001)	$ (314,080)	$ (2,293,488)	$ (1,012,373)	$ (20,646,950)	$ (1,234,062)	$ (131,876)	$ (32,439,831)
Glass	$ (372,405)	$ (18,592)	$ (133,889)	$ (63,030)	$ (1,068,981)	$ (75,135)	$ (8,588)	$ (1,740,620)
Total Commodity Costs (Savings)	**$ (43,439,140)**	**$ (1,986,053)**	**$ (14,307,594)**	**$ (6,399,146)**	**$ (137,350,159)**	**$ (7,889,606)**	**$ (797,091)**	**$ (212,168,790)**

Figure 5-40. Scenario 3 Commodity Summary

	Scenario 3 - Traditional Recyclable and Organic Materials							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Commodity Costs (Savings)								
Paper	$ (9,606,106)	$ (444,099)	$ (3,222,921)	$ (1,386,917)	$ (28,367,954)	$ (1,743,163)	$ (172,982)	$ (44,944,143)
Cardboard	$ (8,971,396)	$ (463,762)	$ (3,372,305)	$ (1,500,104)	$ (27,878,818)	$ (1,826,213)	$ (189,058)	$ (44,201,658)
Metals	$ (10,968,121)	$ (536,712)	$ (3,801,723)	$ (1,762,070)	$ (34,134,057)	$ (2,165,353)	$ (210,976)	$ (53,579,012)
Wood Waste	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$-
Green Waste	$ (885,791)	$ (34,122)	$ (142,937)	$ (68,529)	$ (2,189,032)	$ (140,652)	$ (7,623)	$ (3,468,686)
Compostables	$ (2,876,963)	$ (146,365)	$ (671,970)	$ (309,622)	$ (7,545,069)	$ (512,604)	$ (41,607)	$ (12,104,199)
Mixed Plastics	$ (6,162,618)	$ (284,347)	$ (2,076,376)	$ (916,537)	$ (18,692,411)	$ (1,117,240)	$ (119,392)	$ (29,368,921)
Glass	$ (337,151)	$ (16,832)	$ (121,214)	$ (57,064)	$ (967,786)	$ (68,022)	$ (7,775)	$ (1,575,845)
Total Commodity Costs (Savings)	**$ (39,808,148)**	**$ (1,926,239)**	**$ (13,409,447)**	**$ (6,000,842)**	**$ (119,775,127)**	**$ (7,573,246)**	**$ (749,413)**	**$ (189,242,463)**

Figure 5-41. Scenario 4 Commodity Summary

	Scenario 4 - All Tons Excluding Solid Waste							
	Northern California A (Urban)	Northern California A (Rural)	Northern California B (Urban)	Northern California B (Rural)	Southern California A (Urban)	Southern California B (Urban)	Southern California B (Rural)	State of California
Commodity Costs (Savings)								
Paper	$ (8,756,382)	$ (404,816)	$ (2,937,833)	$ (1,264,235)	$ (25,858,620)	$ (1,588,969)	$ (157,681)	$ (40,968,535)
Cardboard	$ (8,891,589)	$ (439,224)	$ (3,162,479)	$ (1,421,900)	$ (29,130,235)	$ (1,738,652)	$ (179,183)	$ (44,963,262)
Metals	$ (12,204,689)	$ (519,221)	$ (3,699,888)	$ (1,705,320)	$ (40,121,952)	$ (2,100,278)	$ (204,771)	$ (60,556,119)
Wood Waste	$ (70,769)	$ (1,196)	$ (3,977)	$ (1,976)	$ (316,605)	$ (2,599)	$ (248)	$ (397,370)
Green Waste	$ (877,116)	$ (32,398)	$ (135,325)	$ (65,143)	$ (2,280,349)	$ (133,189)	$ (7,285)	$ (3,530,805)
Compostables	$ (2,622,477)	$ (133,418)	$ (612,530)	$ (282,233)	$ (6,877,658)	$ (467,260)	$ (37,926)	$ (11,033,502)
Mixed Plastics	$ (5,617,494)	$ (259,195)	$ (1,892,706)	$ (835,463)	$ (17,038,943)	$ (1,018,413)	$ (108,831)	$ (26,771,045)
Glass	$ (307,328)	$ (15,343)	$ (110,492)	$ (52,016)	$ (882,179)	$ (62,005)	$ (7,087)	$ (1,436,451)
Total Commodity Costs (Savings)	**$ (39,347,843)**	**$ (1,804,810)**	**$ (12,555,230)**	**$ (5,628,286)**	**$ (122,506,542)**	**$ (7,111,365)**	**$ (703,013)**	**$ (189,657,090)**

General Commodity Considerations

IMPACT OF MANDATORY RECYCLING REGULATION

The result of this regulation would be an increase in the supply of these recyclable commodities. The modeling of the value of the materials sold at market does not account for this increase in supply. While it is not known what the total volume of materials sold in these markets is, the increase in supply is assumed to be marginal relative to the total volume of recyclable commodities sold at market.

MARKET VOLATILITY & MARKET DEMAND FOR MATERIAL

The average price per ton for exported recyclable commodities between 2006 and 2008 increased by approximately 40% and decreased by the same amount in the last months of 2008. Over the past 18 months, these recyclable commodities markets have steadily increased the amount they are paying (e.g., corrugated containers were selling for as little as$ 27.50 per ton at the end of 2008 and beginning of 2009 but were selling for as much as$ 145 per ton by June of 2010). This increase in price is, in part, a result of the reduced supply of recyclable commodities in the marketplace.

This market volatility is not possible to predict accurately. Significant changes to market pricing for recyclable commodities would have a correlated effect on the findings of this analysis.

The commodity pricing data used for this study is an average of the values reported during calendar year 2009. HF&H reviewed and evaluated the impact of using average data over a longer period of time (January 2006 is the earliest data reported by the sources used in this study). Using an average of the January 2006 through November 2010 values reported would result in increased commodity values of between 23% and 84% (depending on material type) relative to what was used in this analysis. The 2009 calendar year average was determined to be the most appropriate data set for the purposes of this study as it reflects current market realities and avoids abnormalities such as the record high commodity values during August and September of 2008 or the record low commodity values during October through December of 2008.

POLICY DRIVERS NOT CONSIDERED

The cost savings calculated by the model are based on recent pricing reported for the subject materials. Any changes to policies (e.g., increasing recycled content standards, reducing or eliminating subsidies on virgin feedstock, etc.) may change the value of recyclable commodities and therefore the results presented in each scenario.

Assumed Commodity Value by Material

Data for the value of materials sold at market was gathered from SecondaryMaterialsPricing.com and SecondaryFiberPricing.com using values reported for the Southwestern United States. These sources survey weekly pricing provided by the industry for baled, trailer-load quantities of recyclable commodities.

Data for the value of compost, wood waste, and inert materials was gathered from the industry during the data gathering process. Commodity prices were calculated an average of the values reported during calendar year 2009 due to abnormalities in the commodities markets during 2008. The assumed values for each detailed material type are presented in Figure 5-42 below.

Figure 5-42. Assumed per Ton Values of Various Commodities by Region

	$/Ton Revenue						
	1	2	3	4	5	6	7
Material	Northern A Urban	Northern A Rural	Northern B Urban	Northern B Rural	Southern A	Southern B Urban	Southern B Rural
HDPE	$ 351	$ 351	$ 351	$ 351	$ 351	$ 351	$ 351
PET	$ 370	$ 370	$ 370	$ 370	$ 370	$ 370	$ 370
Aluminum cans and nonferrous metals	$ 1,254	$ 1,254	$ 1,254	$ 1,254	$ 1,254	$ 1,254	$ 1,254
Steel cans and ferrous metals	$ 102	$ 102	$ 102	$ 102	$ 102	$ 102	$ 102
Glass containers	$ 18	$ 18	$ 18	$ 18	$ 18	$ 18	$ 18
Cardboard and paper bags	$ 102	$ 102	$ 102	$ 102	$ 102	$ 102	$ 102
Magazines and catalogs	$ 82	$ 82	$ 82	$ 82	$ 82	$ 82	$ 82
Newsprint	$ 85	$ 85	$ 85	$ 85	$ 85	$ 85	$ 85
Office paper	$ 177	$ 177	$ 177	$ 177	$ 177	$ 177	$ 177
Phone books	$ 93	$ 93	$ 93	$ 93	$ 93	$ 93	$ 93
Compostable paper	$ 8	$ 8	$ 5	$ 5	$ 7	$ 7	$ 5
Dimensional lumber	$ 2	$ 2	$ 1	$ 1	$ 2	$ 1	$ 1
Food	$ 8	$ 8	$ 5	$ 5	$ 7	$ 7	$ 5
Yard waste	$ 8	$ 8	$ 5	$ 5	$ 7	$ 7	$ 5
Concrete	$-	$-	$-	$-	$-	$-	$-

Section 6. Cost Forecast

Forecast Methodology

Summary of Findings

The tonnage estimates developed for the base year (2008) were inflated, as detailed later in this section, using available economic projections to forecast the annual cost of the proposed regulation for each year through 2020. It is not possible to predict the pace or effectiveness of implementation during the period from 2012, when the requirements become effective, to 2020, when the emissions reduction target is to be achieved. In order to forecast the costs through the implementation period, the analysis assumes a linear implementation profile. Under this linear implementation profile, 550,000 MTCO2E reductions are achieved in 2012 and an additional 550,000 MTCO2E in reductions are added each additional year until 2020 when the reductions have accumulated to 5,000,000 MTCO2E per year.

Figure 6-1 below presents a summary of the results of the cost forecasting. These results demonstrate that the total cost of this measure from 2012 to 2020, assuming the linear implementation profile described above, would be between $453 million and $1,080 million. This represents a 2.06% to 4.90% increase in system-wide costs during that implementation period.

Appendices G through J provide detailed summaries of the forecasted tonnage and system costs for each year from 2012 through 2020. These forecasts were prepared using the same methodology described in section 5. While a baseline forecast (Appendix F) was prepared for each year from 2009 through 2020, the proposed regulation envisions the adoption of the measure by 2012. As such, the results of the forecasting are presented from 2012 through 2020 to maintain consistency with the proposed regulation.

Figure 6-1. Summary of Forecasted Cost Increases by Scenario

Increases During Forecasted Period					
	2012	**2013**	**2014**	**2015**	**2016**
Estimated System Costs					
Annual Baseline Costs	$ 2,308,784,596	$ 2,345,010,180	$ 2,385,953,601	$ 2,409,174,653	$ 2,447,306,865
Increase Over Baseline Costs					
Scenario 1	$ (25,350,747)	$ (4,782,877)	$ 15,348,310	$ 37,598,733	$ 60,492,410
Scenario 2	$ (29,290,232)	$ (11,866,647)	$ 7,628,900	$ 26,899,016	$ 47,247,828
Scenario 3	$ (11,700,025)	$ 20,785,810	$ 52,871,148	$ 84,141,140	$ 118,396,760
Scenario 4	$ (18,067,005)	$ 8,070,107	$ 35,042,275	$ 60,626,333	$ 89,065,347
	2017	**2018**	**2019**	**2020**	**Total 2012-2020**
Estimated System Costs					
Annual Baseline Costs	$ 2,484,639,976	$ 2,522,227,594	$ 2,559,142,483	$ 2,597,179,737	$ 22,059,419,685
Increase Over Baseline Costs					
Scenario 1	$ 84,207,627	$ 109,599,656	$ 135,850,930	$ 162,965,833	$ 575,929,875
Scenario 2	$ 68,177,024	$ 91,469,646	$ 114,767,713	$ 138,844,295	$ 453,877,544
Scenario 3	$ 151,287,131	$ 186,181,902	$ 220,843,805	$ 257,587,906	$ 1,080,395,577
Scenario 4	$ 116,324,994	$ 144,232,691	$ 173,392,742	$ 202,341,696	$ 811,029,179

Baseline Costs

As detailed in Section 5, within each scenario, the costs for each region were categorized into the following system components, and presented by target material type: the cost of collecting the materials (collection costs), the cost of processing the diverted materials (processing costs), the cost of transporting the diverted materials for sale in export or domestic markets (transportation costs), the revenue generated by selling diverted materials in export or domestic markets (commodity revenue) and the cost of disposing materials in a landfill (disposal costs).

Inflationary Indices

Due to the uncertainty regarding future inflationary pressures on costs and the current general economic conditions, the forecast costs and revenues are all presented in 2008 dollars.

To estimate the expected tons disposed during the forecasted period, the percentage change in the number of housing permits issued annually, and the annual percentage changes in the employment rate that were used in the Legislative Analyst's Office economic forecast were applied to the tons.

For tons classified as COM-MSW or COM-SH, a decline in employment would directly correlate to a decline in tons collected in the commercial sector; thus, the percentage change in the employment rate was used to forecast tons classified as non-C&D.

For tons classified as COM-C&D or COM-SH-C&D, the change in the annual housing permits was determined to be the best available indicator of the level of C&D tons generated; thus, the percentage change in housing permits was used to forecast tons classified as C&D tons.

Forecast Limitations

AVAILABILITY OF DATA

To determine the future impact of the regulation from 2012 through 2020, HF&H relied on government published indices to forecast future tonnages associated with each scenario. While this is the best available information with which to forecast future costs, any estimate of future conditions is necessarily a forecast and actual results may be different and such differences may be significant.

UNKNOWN/UNKNOWABLE EVENTS, REGULATION, LEGISLATION, ECONOMIC CONDITION

The cost assessment model is based on historical data, thus, it does not account for future regulation, legislation, or unforeseeable events. The projected data provided through 2020 is based on the Legislative Analyst's Office Economic Forecast. The calculations of forecasted costs using indexed values may differ from real cost, resulting in greater or lesser cost. For example, the rebound anticipated by the Legislative Analyst's Office Economic Forecast may be more or less aggressive than the actual economic recovery.

Section 7. Calculator Tool

Introduction and Background

As part of the cost study, the project team developed a Commercial Climate Calculator Tool. Cascadia was the lead consultant in developing this tool with assistance from other project team members as described later in this section.

This tool was intended to support California businesses and multi-family properties in evaluating solid waste handling strategies, including disposal, recovery, and source reduction. The results of the analysis would address the relative financial, diversion, and climate impacts of a range of individual materials.[*] CalRecycle indicated a desire for the following unique tool features.

- **Flexibility** – The tool is flexible for various types of users, from those with little to no data to those with more sophisticated data and knowledge about recovery and waste reduction.

[*] The tool was intended to focus on those materials with the highest GHG intensity. CalRecycle suggested the calculator include the following five materials at a minimum: corrugated cardboard, other paper grades, lumber, plastics, and metals. Ultimately the calculator included a total of eight materials: Cardboard, Paper, Mixed Metals, Mixed Plastics, Glass, Food Scraps, Yard Waste, and Wood (pallets, etc.).

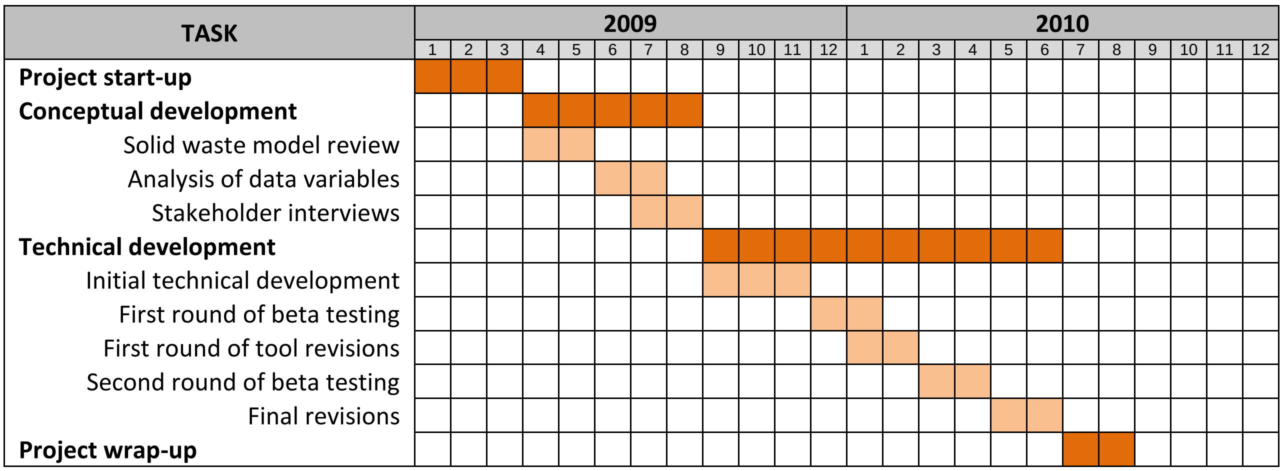
- **Transparency** – The tool is transparent about the data sources and calculations used to arrive at the results.

- **"One-stop shop"** – The tool provides results, resources, case studies, and a customized printable report for the user, all without a user guide or additional support files.

- **California specific** – The tool is specific to California, including all geographic regions and a wide range of industries in the State.

The figure below shows a timeline for this project.

Figure 7-1. Project Timeline



Development Process

To build the most relevant, useful tool, Cascadia led at two-stage development process, including a conceptual and a technical stage. Throughout each stage, the project team engaged a large and diverse set of stakeholders.

Conceptual Development

Cascadia initiated the project with a conceptual development process, consisting of three primary phases, each of which is described further in the following sections.

- Review of existing solid waste models

- Analysis of multi-family and rural-urban factors

- Stakeholder interviews

EXISTING MODELS

First, Cascadia conducted thorough web-based research of existing solid waste planning models, with particular focus on the U.S. Environmental Protection Agency's WARM and WasteWise models. This research confirmed that there was need for a new tool to demonstrate the benefits of waste reduction and recycling to businesses with little to no knowledge or information about their waste and recycling systems.

MULTI-FAMILY DATA ANALYSIS

Next, Cascadia evaluated whether the tool could distinguish between different types of multi-family housing, such as mobile home parks versus multi-unit apartment buildings. California's multi-family waste characterization data does not delineate between different types of multi-family housing, therefore the tool could not either.[*]

URBAN-RURAL DATA ANALYSIS

Similar to the multi-family analysis, Cascadia evaluated the value of including regional or rural characteristics in the design of the tool. To do so, we examined the availability of regional cost and waste characterization data.

Consistent with the HF&H cost study, the State was separated into four geographic regions, three of which are further divided into rural and urban sub-regions.

HF&H provided waste and recycling cost data for each of the seven regions. The calculator utilized this data, allowing users without access to actual waste and recycling costs to take advantage of pre-loaded cost data for their region.

Cascadia provided industry-specific data from California commercial waste characterization studies to allow users to estimate their waste quantity and composition. This data separates information by industry group, and not by region.

Therefore, the tool provides users with regional-specific cost data and industry-specific waste characterization data.

STAKEHOLDER INTERVIEWS

Before building the tool, Cascadia determined that phone interviews with key stakeholders were necessary to:

- Maximize the usefulness and relevance of the tool;
- Better understand the types of users and their interest in using this type of tool;
- Determine the types of information users are likely to have available while using the tool;
- Identify common waste reduction and recycling scenarios or options users would like to evaluate using the tool; and,
- Anticipate potential challenges users may have in accessing or using the tool.

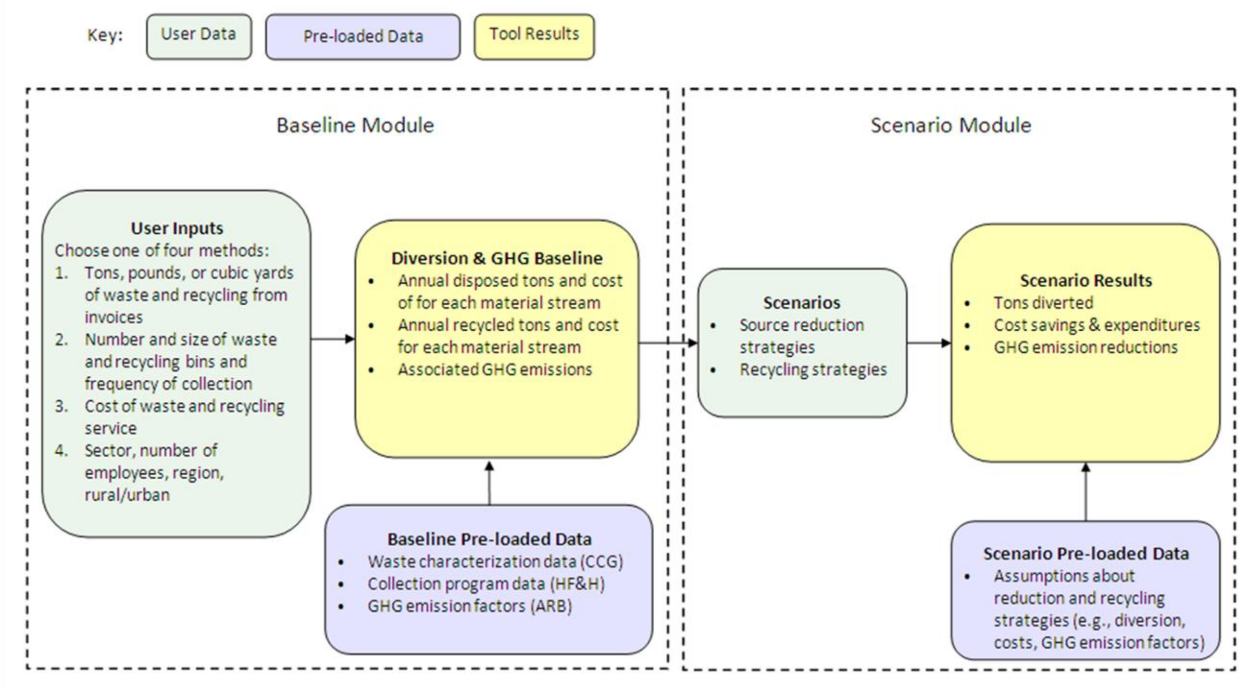
Cascadia, HF&H, CalRecycle staff, CRRA board members, consultants, recyclers, and other industry experts provided Cascadia with suggestions of key people and organizations who would offer beneficial feedback to inform the development of the tool. Stakeholders represented five primary sectors: businesses and institutions, recyclers, local government, non-profit and business groups, and consultants.

[*] The project scope did not address or include resources for additional primary research to enhance or provide additional source data.

Cascadia completed 20 interviews in July and August 2009. The list of interviewees and the interview questions can be found in Appendix N.

The schematic below shows Cascadia's initial conceptual design for the tool. This chart was shared with each stakeholder in advance of and during the interview process.

Figure 7-2. Sketch of Commercial Climate Calculator Tool



The following key themes emerged from the stakeholder interview sessions.

- There is a wider range of potential user groups than anticipated for this project, including a wide range of businesses, multi-family property managers, as well as service providers such as consultants, local government staff, and recyclers.
- Tool users will likely be interested in many different types of outputs, such as per-employee metrics, educational resources, and customized reports.
- Users are likely to have some idea about their waste and recycling collection services to input into the calculator.
- There are several challenges that the calculator will have to address in order for it to be useable and relevant to users, such as providing clear instructions, case studies, and distinguishing it from similar tools such as EPA's WARM model.
- Businesses are considering a wide range of waste reduction and recycling scenarios, such as composting programs, employee education campaigns, and improving existing programs.

- The distribution channels that should be utilized to effectively share the calculator with targeted users include: CalRecycle, CA Department of Conservation, CA Department of Corporations, CA and local Chambers of Commerce, local governments, CA Association of Cities and Counties, and COOL California.org.
- There is an opportunity to collaborate with the ARB and UC Berkeley as they finish building a web-based carbon footprint calculator for businesses. The data and features from the CalRecycle tool can be incorporated into this more comprehensive, online tool for California businesses to gain a better understanding of their footprint impacts and opportunities.

Cascadia and HF&H shared with CalRecycle the results and recommendations from all three phases of the conceptual development—the multi-family and rural-urban analysis, and the stakeholder interview process. Both parties agreed to adopt specific recommendations before proceeding with the technical development process.

Technical Development

The technical development process followed the conceptual process, and consisted of five primary phases:

- Initial technical development;
- First round of beta testing;
- First round of tool revisions;
- Second round of beta testing; and,
- Final revisions.

Each of the five phases is detailed in the sections that follow.

Initial Technical Development

Cascadia began the technical development process by creating the tool in Microsoft Excel, the platform specified by CalRecycle. The user interface and the source data spreadsheets were developed separately, but in parallel. Cascadia shared preliminary drafts of the user interface with CalRecycle staff. Based on CalRecycle feedback, Cascadia made refinements, gained consensus on the final format and functions of the interface, then connected it with the back-end source data. Once the final draft of the tool was developed and before the first round of stakeholder testing, Cascadia and HF&H conducted internal testing to ensure all features, calculations, and data in the tool were understandable and accurate for the average user.

First Round of Beta Testing

Next, the consultant team facilitated stakeholder testing sessions. These sessions were intended to:

- Maximize the usefulness and relevance of the tool;
- Identify areas of confusion;
- Test the accuracy of the tool’s estimated results; and,

- Understand potential challenges users may face while using the tool.

A total of 11 stakeholders tested the beta tool, and represented a variety of geographic areas and sectors. In addition, several members of CalRecycle staff participated in the testing process. For a complete list of the testers, please see Appendix N. Stakeholders and those who participated in the phone interviews during the conceptual development process were recommended by CalRecycle staff.

In December 2009 and January 2010, the consultant team visited testers in-person at their workplace so as to mimic "real world" conditions in which business and multi-family users would be using the tool. Testers were provided a copy of the beta version of the tool to load on their computer, and the consultant observed them as they used the tool. The consultant used a testing guide to note issues as the users worked their way through each sheet in the tool. A copy of the testing guide and other supporting materials are in Appendix N.

Cascadia collected completed copies of the testing guide and tool used by each stakeholder. Stakeholder and tester feedback was consolidated and sorted by spreadsheet and type (e.g., language and instructions, data and calculations). Cascadia shared the consolidated tester feedback and recommendations for tool revisions with the CalRecycle team. All revisions were agreed on by the full project team before Cascadia began work on the next version of the tool. A full list of stakeholder feedback can be found in Appendix N.

Substantive stakeholder recommendations that were incorporated into the next draft include:

- Add manufacturing in list of business sectors.
- Add in average multi-family recycling data.
- Adjust so that recycling data do not seem too low for office-based businesses.
- Add source reduction cost savings associated with not paying for materials in the first place.
- Revise municipal solid waste (MSW) and mixed recycling density calculations to allow for different densities for each sector, based on average composition.
- Provide an opportunity for users to enter current rate data for their community or business to override default data and provide more accurate cost savings results.
- Provide case studies that allow users to compare their waste reduction and recycling levels to the average business.
- Add a "Next Steps" sheet with instructions on what the business can do next and how to do it (e.g., look at garbage bill, talk to hauler, call local solid waste municipality or county).

A small number of recommendations were not addressed because of data or MS Excel limitations, or because suggestions were outside the project scope or comprised usability. These recommendations and consultant responses are included in the table below.

Figure 7-3. Stakeholder Recommendations Not Addressed

Tester Recommendation	Consultant Response
The data for the education sector do not differentiate between private schools, public schools, and universities, nor are they based on student population.	The disposal and recycling data available for this sector are based on FTEs, not on type of institution or student population. Including these two variables would increase the accuracy of the calculations, but there is no detailed disposal and recycling data currently available for these individual education sub sectors.
No data are available for malls or the aerospace industry.	There is currently no detailed disposal and recycling data available for these sectors.
Calculator does not account for resource recovery at material recovery facilities (MRFs).	Adjusting for resource recovery at MRFs would require detailed regional data about MRF recycling recovery rates, which is not publicly available at this time.
GHG emission factors for paper, food scraps, yard waste, and lumber could be improved. Paper (carbon storage) Lumber (emission factors for recycling reflects reuse, not combustion) Food scraps and yard waste (benefits of composting)	The calculator uses the most accurate GHG emission factors that are available at this time (based on those emissions factors used in the EPA WARM model). As better emission factors become available, they can be updated in the calculator to increase the accuracy of the GHG calculations and results. CalRecycle anticipates updating the emission factors in the tool using California-specific factors being developed by ARB.
Provide a list of materials that are important for user to track.	The materials in the calculator are the common materials that nearly all businesses should track. Customizing this list for each business would involve complex programming.
Add polystyrene to material types.	Although polystyrene does have important environmental impacts, this calculator is focused on GHG emissions, where polystyrene has a much smaller impact than those materials currently included in the calculator, and are called out in the AB 32 Scoping Plan. Additionally, polystyrene does not contribute to measurable diversion by weight or cost savings for businesses.
Determine whether it is possible to easily add “Bottles and Cans” or “Bottles and Cans with deposit” to the material list for the makeup.	Adding “Bottles and Cans” to the material list would remove aluminum and steel cans from metals, plastic bottles from mixed plastics, and glass containers from glass, which makes the material list less relevant to some users. In addition, this change would require complicated and time-intensive calculations.
Create a new sheet for compost, separating it from recycling	Keeping compost on the recycling sheet streamlines the calculator to keep it easier to use for most businesses.
Make it easier to change makeup (e.g., user sees one material that they know is wrong, changes it, calculator automatically generates other composition).	Although this would be a good feature, it would be difficult to implement and maintain the current clarity of the makeup sections. Furthermore, if the user changes a material and the calculator automatically scales the makeup of the other materials, there is no guarantee that data would be more accurate than the user’s actual data.

Tester Recommendation	Consultant Response
Allow user to easily change makeup using tons or percentages.	This is a good idea, but would make the entry section more complicated. However, the calculator provides data for the user to quickly convert percentages into tons.
Explore feasibility of having graphs with a different color for each material to see how much each is contributing to the overall benefits.	A graph with too many different colors could be more confusing than helpful. Again, we want to keep the interface as simple and helpful as possible for the average business.
Add return on investment (ROI) calculations to the Future Benefits sheet.	Adding these calculations would require us to ask the business for several inputs. For most businesses, there will be little (if any) upfront investment required to increase recovery or further reduce their waste. Larger businesses more likely to make capital investments in equipment likely already have in-house established systems and thresholds for calculating ROI or other financial metrics to justify capital purchases.

FIRST ROUND OF TOOL REVISIONS

In February and March 2010, Cascadia incorporated the revisions agreed upon with CalRecycle into the next version. Once the next draft of the tool was developed and before the second round of stakeholder testing, the project team conducted internal testing to ensure all features, calculations, and data in the tool were understandable and accurate for the next round of testing.

SECOND ROUND OF BETA TESTING

In March and April 2010, the consultant team conducted a second round of stakeholder testing. Similar to the first round of testing, this testing was necessary to:

- Maximize the usefulness and relevance of the tool;
- Identify areas of confusion;
- Test the accuracy of the tool’s estimated results; and,
- Understand potential challenges users may face while using the tool.

In addition to these goals, a second round of testing was necessary to ensure that those revisions made after the first round of testing enhanced the usability of the tool and that new features were working correctly.

A total of ten stakeholders participated in the second round of testing, and represented a variety of geographic areas and sectors. To ensure some continuity and that round one feedback was adequately addressed, three of the stakeholders had also participated in the first round of testing. Several members of CalRecycle staff also participated in the testing process. Other stakeholders were recommended by CalRecycle staff and were drawn from CalRecycle’s past Waste Reduction Awards Program (WRAP) award winners. For a complete list of the testers, please see Appendix O.

For convenience, some stakeholders requested that they test the tool on their own time without having to arrange a time with the consultant. They agreed to provide direct feedback by completing the testing guide (see Appendix O for a copy of the guide). As in round one, all stakeholders were provided a copy of the beta version of the tool to load on their computer for testing.

CalRecycle supplemented the consultant-led testing process by inviting members of their Local Assistance and Market Development (LAMD) email list serve to test the tool. A full list of those who participated in CalRecycle's testing process can be found in Appendix O. A total of 19 testers provided their feedback to CalRecycle, and the CalRecycle project manager consolidated these recommendations for Cascadia.

All stakeholder and tester feedback was consolidated and sorted by spreadsheet and type (e.g., language and instructions, data and calculations). Cascadia shared the consolidated tester feedback and recommendations for tool revisions with the project team. All revisions were agreed on by the full project team before Cascadia began work on the final version of the tool. A full list of stakeholder and tester feedback from the second round of testing can be found in Appendix O.

Almost half of the feedback received in this round of testing was very positive, indicating that the calculator was a useful and relevant tool that testers would be excited to use in the future.

Substantive stakeholder recommendations that were incorporated into the final tool include:

- Prompt the user to enter missing data.
- Provide calculator in MS Excel 2007 and 2003 versions.
- Allow user to enter waste/recycling composition by weight or volume.

The following recommendations were not addressed because of data or MS Excel limitations, or because suggestions were outside the project scope or comprised usability. These recommendations and consultant responses are detailed in the table below.

Figure 7-4. 2nd Round Stakeholder Recommendations Not Addressed

Tester Recommendation	Consultant Response
The data for the hotel sector do not account for square footage, occupants, restaurants in hotel.	The disposal and recovery data available for this sector are based on FTEs, not on area, occupants, or building features. Including these variables would increase the accuracy of the calculations, but there is no detailed disposal and recovery data currently available for these variables.
Business type does not adequately apply to a multi-tenant commercial property.	The calculator will be revised with some instructions about what to do in case a business's sector does not appear on the list. A multi-tenant property will have the option to complete a calculator for each of its tenants, using the "shared container" feature, or it may enter its own quantity and composition data. Default waste and recovery data for multi-tenant properties are not available at this time.

Tester Recommendation	Consultant Response
Allow user to enter site-specific information to change WARM numbers (e.g., landfill collection efficiency and transportation distances).	Although this calculator does not include WARM's back-end methodology for calculating custom emission factors, the user may use the WARM model to calculate emission factors with site-specific information and enter the new factors into the calculator. The final emission factors in the publicly-released calculator will include California-specific emissions factors provided by the ARB for some selected material types while the balance of emissions factors used are from the WARM model.
If one check box is selected, the other should automatically uncheck.	This is not possible to do with check boxes (and without macros) in Excel. An alternative would be to use radio buttons, but then the user would not be able to select multiple recycling programs.
Use buttons instead of links.	Buttons require macros, which this calculator does not use. CalRecycle and the development team decided early in the development of the calculator not to use macros in order to keep the calculator transparent and secure.
Add a "clear" button to reset and clear data.	Same as previous.
Only ask if dumpster is shared once.	Because this question applies to different methods of calculating both quantity and cost, this cannot be simplified.
Allow business to enter revenue from recycling in a separate column, instead of negating cost.	The calculator currently adequately addresses recovery revenue; businesses that receive revenue from recovery are instructed to enter a negative cost in the cost column. There is not space to add another column for revenue.
Allow custom rates to account for number of containers.	The tool calculates rates for multiple containers by multiplying the rate for one container by the number of containers. Adding another column for number of containers to affect rates would create unnecessary complexity in the calculations. If additional service volume is required, the calculator defaults to assume multiple containers.
Allow users to enter data for trash amount, bill, and specific containers.	The user is able to enter all of this information, but if the actual tonnage is entered, it is unnecessary to enter container information. The actual tonnage will be the most accurate.
Allow users to enter monthly cost in addition to annual cost.	This would require more effort from the business and a more complicated input form and would not make results significantly more accurate.
Add more than 6 fields for single recycling program (Oracle has 31?!).	For practical purposes, the number of fields in the calculator must be limited. Businesses with more than 6 separate recycling programs could use multiple copies of the calculator and add up the final results.
Provide an option for "paper and cardboard recycling" similar to "food scraps and yard waste" options, since some jurisdictions recycle these together.	The number of recovery combinations in the calculator must be limited for practical purposes. However, if a business has paper and cardboard combined program, it can still capture the results by entering two separate programs.

Tester Recommendation	Consultant Response
Allow calculator to handle compactor or baler use.	Most businesses that have compactors also know the tonnage of each pickup. The business can enter tons instead of service levels for increased accuracy. Adding compactors to the service levels offered would complicate the user's inputs and the background calculations, since every compactor is different and compaction ratios vary.
Use different term for "Makeup."	Feedback was mixed about the correct terms to use to reach the intended audience. For most businesses, these terms are generally interchangeable and acceptable.
Show average cost benefits and carbon emission reductions for neighboring cities, areas, industries to encourage better recycling.	The calculator does provide average waste and recovery data to benchmark performance against industry profiles. Comparing average cost and carbon benefits from other cities and areas is outside the scope of this project.
Make it clear that calculator should only be used by businesses directly billed for collection services. Typically no way for savings to be passed on to tenants.	The calculator is intended for use by any business—even those who are not directly billed for collection. Although the business may not realize the direct cost savings, it could share the results of the spreadsheet with its property manager.
Provide explanation of charts.	The vast majority of testers felt that the charts were self-explanatory and helpful graphical representations of the results. Additional explanation would clutter the page.
Explain how future projections are calculated.	These explanations are described in the introduction, calculations, and background data pages of the calculator. Including an additional description here would clutter the page.
Add: Burrtec Waste Industries.	To keep the resource list to a manageable length, the calculator does not include private haulers or service providers. Listing all private haulers would require hundreds of entries to cover the whole State.
Add options for 14, 20, 30, 40 cubic yard rates to custom rates page and add a way of accounting for if it is a compactor.	The calculator does not accommodate custom rates for compactors; compactors are not provided as a service level option. Adding compactors to the service levels offered would complicate the user's inputs and the background calculations, since every compactor is different and compaction ratios vary.
Write for a business audience (e.g., "garbage" instead of "trash").	Feedback was mixed about the correct terms to use to reach the intended audience. For most businesses, these terms are generally interchangeable and acceptable.

Tester Recommendation	Consultant Response
Add the following materials: food-soiled products, plastic film, toner cartridges, computers, office furniture, tires, specific metals (aluminum, copper, brass, steel), cooking oil, paint, batteries, aerosol cans, machine oils, construction materials; include waxed cardboard and food-soiled paper in food scraps; categorize plastic (LDPE, HDPE), paper (white, craft), metals (mild steel, copper); add "other" or custom field to enter materials not listed.	The materials list in the calculator was created through careful consideration and collaboration through CalRecycle and the consultant team. The current list includes those broad material groups that are most relevant for the majority of businesses. These material types also have the most robust average sector-specific composition data. Although adding more specific material types would make some of the calculations more accurate, it would also dramatically complicate the calculator for less advanced users.
Provide options for out of state customers to use calculator.	The background data for the CalRecycle calculator are California specific. Although an out of state business could use the calculator by entering all its own data, the CalRecycle calculator is intended for California businesses.

Final Revisions

In May and June 2010, Cascadia incorporated those revisions agreed upon with CalRecycle into the final version of the tool. Once the final draft of the tool was developed, the project team conducted internal testing to ensure all features, calculations, and data in the tool were understandable and accurate for the final release.

The final tool is designed to be:

- Flexible for various types of users, from those with little to no data to those with more sophisticated data and knowledge about recycling and waste reduction;
- Transparent about the data sources and calculations used to arrive at the results;
- A "one-stop shop" because it provides results, resources, case studies, and a customized printable report for the user; and
- Specific to California and major geographic regions throughout the State.

Background Data

It was necessary to populate the tool with average source data to ensure it could be used by businesses with little to no data for their waste and recycling systems. There are three primary sets of data provided to the user:

- Waste and recycling data – including quantities, composition, and densities by material and industry group. These data are based on generator-based California waste and recycling characterization studies and material densities from several Cascadia waste studies.
- Cost data – based on the average regional results from the HF&H cost study, and including collection, processing, final disposal, and recoverable materials market costs.

- GHG emissions factors – based on EPA WARM and ARB material-specific factors.

WASTE AND RECYCLING DATA

Disposal and recoverable materials composition and quantity profiles for specific industry groups were extracted from the following two waste characterization study reports:

- *Characterization of Municipal Solid Waste for the City of Los Angeles*, City of Los Angeles Bureau of Sanitation, Solid Resources Citywide Recycling Division, 2001
- *Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups*, California Integrated Waste Management Board, 2006

Material categories from the two reports were reconciled with each other and then were organized and combined to match the shorter list of materials identified for the tool by the project team.

Material densities are based on the following sources as indicated in the Background_Data sheet in the tool:

- *CTSWCS: 2004 California Targeted Statewide Waste Characterization Study: Detailed Characterization of Construction and Demolition Waste*
- *EPA Business Guide: Business Waste Prevention Quantification Methodologies - Business Users Guide: Washington, D.C. and Los Angeles:* U.S. Environmental Protection Agency, Municipal and Industrial Solid Waste, and University of California at Los Angeles Extension, Recycling and Municipal Solid Waste Management Program, 1996. Grant Number CX 824548-01-0.
- *EPA Government Guide: Measuring Recycling: A Guide for State and Local Governments. Washington, D.C.:* U. S. Environmental Protection Agency, 1997: Phone 1-800-424-9346; http://www.epa.gov. Publication number EPA530-R-97-011.
- *EPA Methodology: Methodology for Characterization of Municipal Solid Waste in the United States:* U. S. Environmental Protection Agency, 1994: Phone 1-800-424-9346; http://www.epa.gov. Publication number EPA530-R-96-001.
- *FEECO: FEECO International Handbook, 8th Printing* (Section 22-45 to 22-510). Green Bay, Wisconsin: FEECO International, Inc. Phone (920) 468-1000; FAX (920) 469-5110.
- *Tellus: Conversion Factors for Individual Material Types Submitted to California Integrated Waste Management Board.* Cal Recovery Inc., Tellus Institute, ACT…now, December 1991.

DATA LIMITATIONS

Though the tool utilized the best available data at the time of completion, the consultant team suggests the following as areas where data could be added or enhanced:

- **Characterization data—**Cascadia recommends three primary improvements to the waste and recycling characterization source data.
    - Add recoverable materials data for small hotels and all manufacturing sectors (when added together, these sectors make up 22 of the 36 included in the calculator).

    - Develop separate waste and recoverable materials profiles for lower versus higher education sectors, and the major multi-family sectors such as RV or mobile home parks versus condominiums or apartments.

    - Incorporate waste and recoverable materials quantities for hotels based on the number of occupied rooms, more closely related to the generation of these materials.

- **Cost data** – While cost data is pre-loaded into the tool, it can become antiquated quickly as the costs in the industry change frequently. This data could be kept up to date through updates to the cost study or by conducting regular surveys of rates, for example, as part of the annual reporting process.

- **GHG data** – The RERF and CERF data should be updated as new information becomes available to ARB and CalRecycle for other material types or to improve upon the emissions reduction factors associated with materials in the calculator currently.

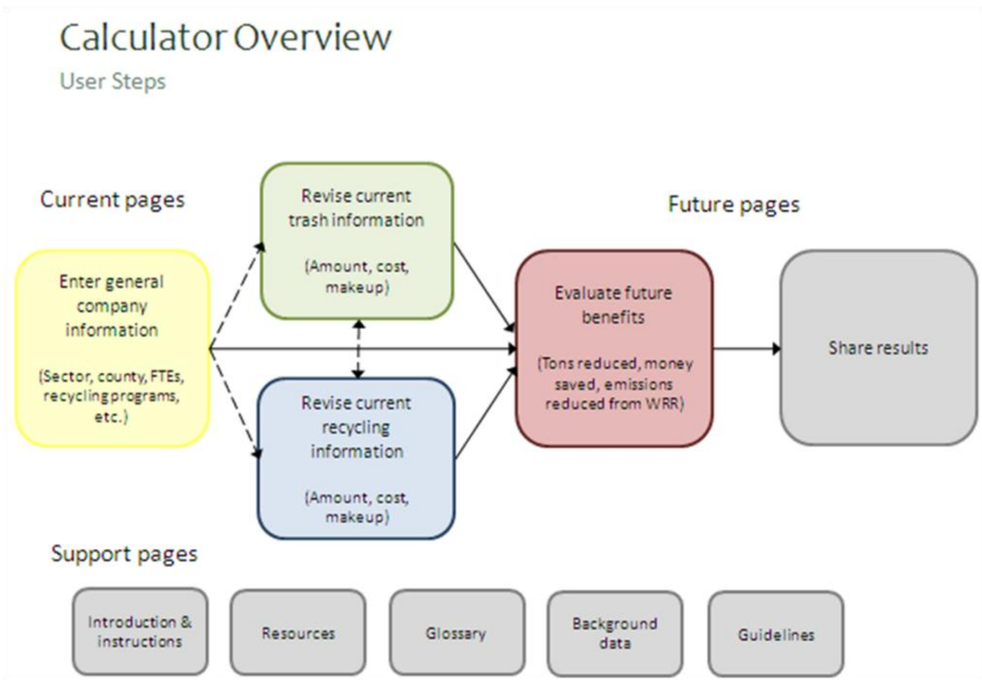
The tool is designed to be updated as better data become available. CalRecycle staff received training to make these updates in the future.

Calculator Details

OVERVIEW

The following diagram illustrates the basic structure of the tool. The primary user interface sheets are shown at the top, and the supporting sheets are shown at the bottom.

Figure 7-5. Calculator Overview Diagram



CalRecycle specified that the tool should be built using MS Excel (both 2007 and 2003), and without the use of macros. These specifications broaden the use of the calculator by a wide range of commercial users.

Throughout the tool, there is color shading to indicate the type of cell.

- Yellow cells – indicate where user inputs are needed.
- Green cells – show where numbers are calculated automatically by the tool.
- Grey cells – do not require the user to input data, but are available if the user has data available.

Other user-friendly features include:

- Error messages – The tool alerts users of missing information or errors through messages in red text that appear when an error has occurred or missing data are required.
- Hyperlinks – There are several hyperlinks throughout the tool that allow the user to toggle between individual worksheets. They are located at the end of each sheet to take the user to the next sheet, and within the sheets to direct users to reference information or other relevant sections.

Description of Each Module

This section provides an explanation for each tool module (also referred to as "sheet" or "worksheet") including the objectives, features, functions, calculations, and source data.

Intro

Because the calculator is a stand-alone tool without an accompanying user guide, the Intro worksheet provides an overview of the tool, an information needs checklist to orient the user to the data requirements, a summary of the other worksheets in the tool, and a brief description for each sheet. In the "Using the Tool" section, the name of each worksheet is a hyperlink, so the user can simply click on the name of the worksheet to access it. (This is an example of a feature intended to assist users unfamiliar or at a beginner level with the MS Excel program.)

After reading about the calculator on the Intro sheet, the user is guided to the General_Info sheet.

1. General_Info

General_Info is the only sheet that requires the user to enter data specific to their organization. There is a total of five data inputs required:

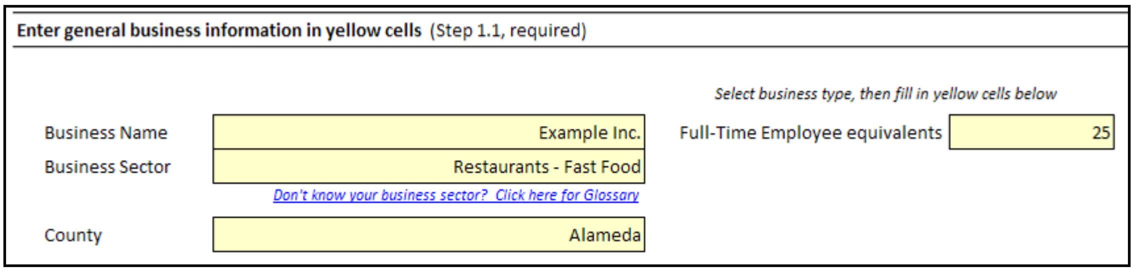
- **Organization name** – The organization name feeds into a customized report the user can download or print after using the tool.
- **Sector** – There are 36 sectors the user can select from. This selection pulls industry average waste and recycling characterization data for the user's sector.
- **County** – All California counties are listed in this drop down box. This selection pulls regionally-specific cost data.
- **Full-time equivalent employees**– Most businesses are prompted to enter the number of full-time equivalent employees; however multi-family complexes enter the number of units and event venues enter the number of visitors. This data pulls industry average waste and recovered material quantities by material.

- **Recycling program** – The user is asked to select whether or not their organization has a recycling program, and if so, the program type (i.e., no program, mixed material, separate material). This entry pulls industry average recycling characterization data.

The user input process for the General_Info sheet is described in more detail below.

In Step 1.1, the user first enters the organization name and selects the sector from a drop-down list. If the user does not know which sector to select, they can access a full list of sectors in the Glossary sheet by clicking on the blue hyperlink below the sector box. The 36 sectors in the calculator reflect those used in the waste characterization studies (described in the Background Data section of this report). Depending on the type of business selected, the user will also be required to enter either full-time employee equivalents (most businesses), number of occupied multi-family units (multi-family living complexes), or number of visitors per year (event venues). The combination of sectors and employees/units/visitors automatically selects industry average waste and recycling characterization profiles with tons per employee/unit/visitor per year by each of the material categories (e.g., cardboard, paper, glass).

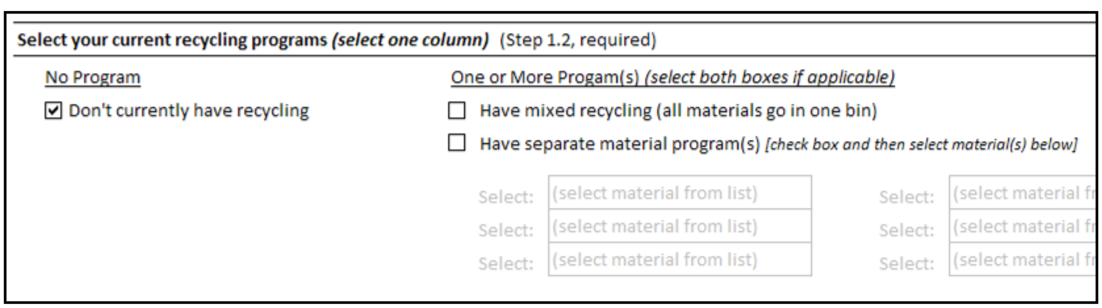
Figure 7-6. Step 1.1



The user selects the county from a drop-down list of all California counties. The county selected determines the default per ton cost values.

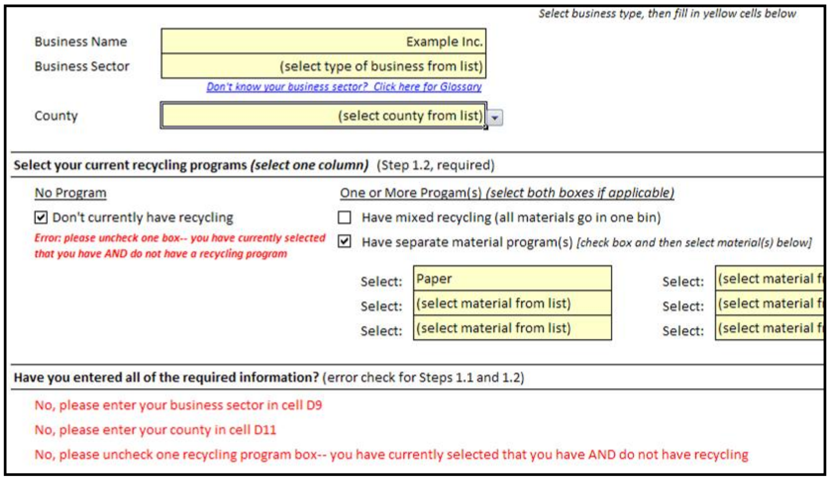
In Step 1.2, the user may also select whether the business currently has a recycling program. The calculator defaults to check the box "Don't currently have recycling." If a business does recycle, the user must uncheck the box under "No Program" and select one or both boxes under "One of More Programs," which are "Have mixed recycling" or "Have separate material programs." If the user selects the separate material programs box, the user must also select which materials are included in these programs. If a program is selected, the tool pulls industry average recycling characterization data for the user. However, recycling characterization data is only for 14 of the 36 sectors.

Figure 7-7. Step 1.2



As described previously, the calculator does not use macros. Instead, users are alerted of missing information or errors through messages in red text that appear when an error has occurred. Figure 7-8 shows an example of the error messages.

Figure 7-8. Error Checking Example #1


Select business type, then fill in yellow cells below

Business Name: Example Inc.
Business Sector: (select type of business from list)
Don't know your business sector? Click here for Glossary
County: (select county from list)

Select your current recycling programs *(select one column)* (Step 1.2, required)

No Program
☑ Don't currently have recycling
Error: please uncheck one box-- you have currently selected that you have AND do not have a recycling program

One or More Progam(s) *(select both boxes if applicable)*
☐ Have mixed recycling (all materials go in one bin)
☑ Have separate material program(s) *[check box and then select material(s) below]*

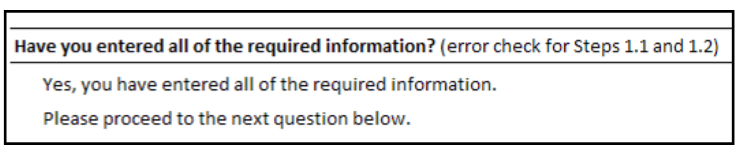
Select: Paper
Select: (select material from list)
Select: (select material from list)
Select: (select material f
Select: (select material f
Select: (select material f

Have you entered all of the required information? (error check for Steps 1.1 and 1.2)

No, please enter your business sector in cell D9
No, please enter your county in cell D11
No, please uncheck one recycling program box-- you have currently selected that you have AND do not have recycling

If the user has completed all of the necessary steps, the calculator instructs the user to continue, as shown in Figure 7-9, and no error messages appear.

Figure 7-9. Error Checking Example #2


Have you entered all of the required information? (error check for Steps 1.1 and 1.2)

Yes, you have entered all of the required information.
Please proceed to the next question below.

In the final step of the General_Info page, Step 1.3, the user is prompted to enter any information about the amount, cost, or makeup of their current trash or recoverable materials. If the user does not have any information, they proceed directly to the Future_Benefits page to evaluate the benefits of future waste reduction and recoverable material scenarios. If the user does have this information, the tool directs the user to the Current_Trash and/or Current_Recycling worksheets to enter more accurate information.

2. CURRENT_TRASH

In the Current_Trash sheet, the user may provide more specific information about their current trash handling programs. This data then overrides the default averages for their sector and region. User inputs in this sheet are organized into three primary sections:

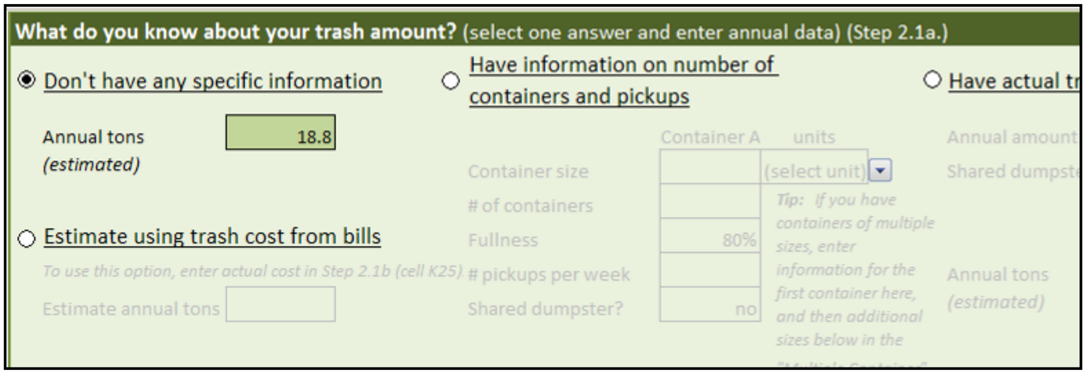
- **Trash amount** – If the user has more specific information, they can enter the amount of trash their organization disposes.
- **Trash cost** – If the user has more specific information, they can enter the cost of their trash collection services.

- **Trash makeup** – If the user has more specific information, they can specify the makeup, or composition of their waste (presence of certain materials).

The user input process for the Current_Trash sheet is described in more detail below.

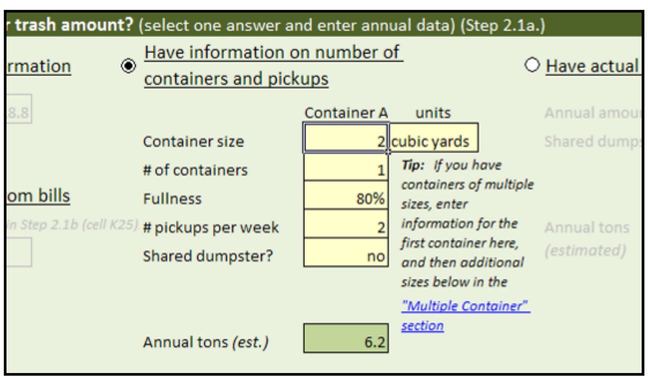
In Step 2.1a, the calculator prompts the user to enter information about their trash amount. The user selects one of four answers, which calculate the trash amount in different ways. Depending on the user's selection, the calculator will highlight the cells that must be completed for the calculations to work. Figure 7-10 shows the default option; the user does not have any information and the calculator estimates annual tons based on the average tons per employee per year for the selected sector, the number of employees, and whether or not the business has recycling.

Figure 7-10. Step 2.1a Default



The next option, shown in Figure 7-11, is for instances where the user has some information about trash service levels. In this option, the user selects the "Have information on number of containers and pickups". The user then enters the container size and units, number of containers, fullness, number of pickups per week, and, if the container is shared with other organizations, the percent of the waste from the user's organization. The calculator converts the volume from the containers into tons using the waste density conversion factor shown on the Background_Data sheet. The calculator estimates this default waste density conversion factor based on the composition of trash; however, the user is able to revise the density factor if desired.

Figure 7-11. Step 2.1a Option #2



If the user has multiple containers, the service level entry option is expanded at the bottom of the page as shown in Figure 7-12. The user can enter up to six different containers in this section.

Figure 7-12. Step 2.1a Option #2 Continued (Multiple Bin Section)

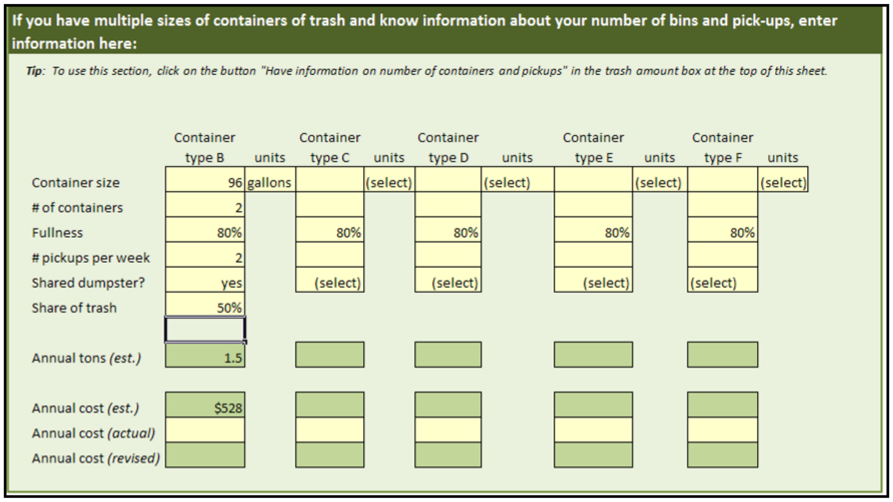
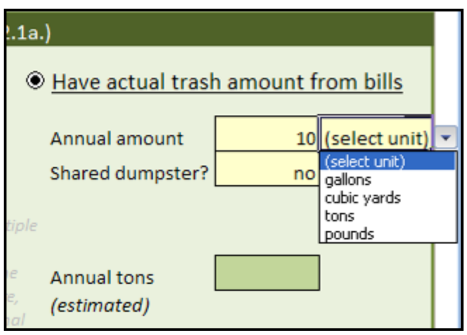


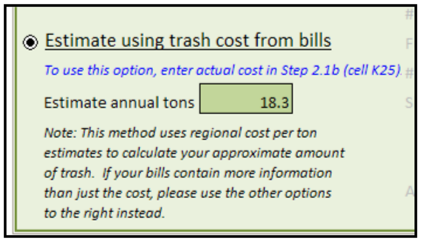
Figure 7-13 shows the most accurate option for calculating the amount of trash, in which the user selects “Have actual information” and enters the actual amount of trash from bills. The amount may be entered in gallons, cubic yards, tons, or pounds.

Figure 7-13. Step 2.1a Option #3



The fourth option for entering trash amount data allows the user to estimate the quantity using the cost of trash from trash bills. In order to use this option, the user must first enter the actual cost of the trash in the cost section (described below). Once the trash cost has been entered, the calculator uses regional cost per ton estimates to calculate the amount of trash.

Figure 7-14. Step 2.1a Option #4

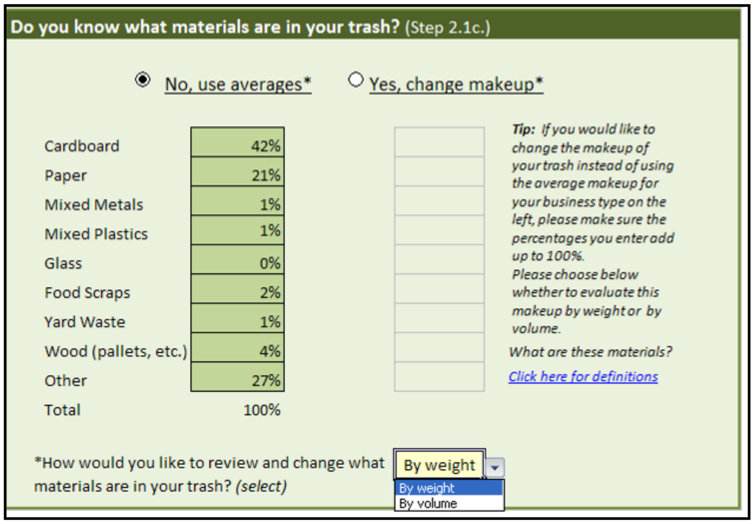


After choosing whether to revise information about the trash amount, the user has the option to improve the accuracy of the cost of their trash in Step 2.1b. Both options are shown below in Figure 7-15. The default option is that the user does not have any information about the cost of trash. In this option, the calculator applies regional cost per ton estimates, based on the user's selected county. If the user has entered specific rate information for their organization or community (entered in a separate Custom_Rates sheet), the calculator applies these rates to the amount of trash from Step 2.1a. If the user has actual cost information, the user may click "Have actual cost from trash bills" and enter the information into the calculator. If the user has multiple bins, they may either enter the total cost of servicing all bins, or enter the cost of each container into the appropriate cells.

Figure 7-15. Step 2.1b. Trash Cost Section

Finally, after revising amount and cost information, the user may revise their trash makeup, or composition. Step 2.1c is shown in Figure 7-16.

Figure 7-16. Step 2.1c



The default option is that the calculator provides the composition, which is calculated based on the sector and what, if any, materials the user stated that the business recovers. The calculator provides this default data by weight or by volume. If the user wishes to enter a new composition, the user selects “Yes, change makeup” and enters new percentages for each material type. If the user has selected to review and change composition by weight, then the user enters the new makeup by percent by weight. Otherwise, the user enters the new makeup by percent by volume. Until the user has entered a new composition that totals 100 percent, the calculator will remind the user with an error message that the total does not yet equal 100 percent.

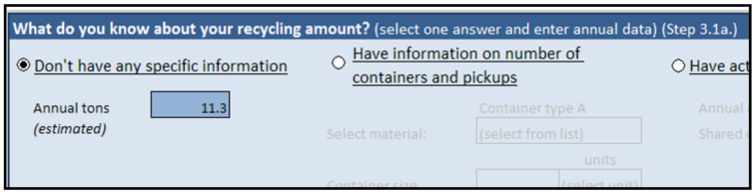
At the bottom of the Current_Trash sheet, the calculator will provide error messages, similar to those described in the report about General_Info, to alert the user if any information is missing that will result in calculator malfunctions.

After the user has reviewed the information and made any desired changes, the user can continue to a similar analysis of their current recycling, or if the user does not have recycling information, they can proceed directly to Future_Benefits.

3. CURRENT_RECYCLING

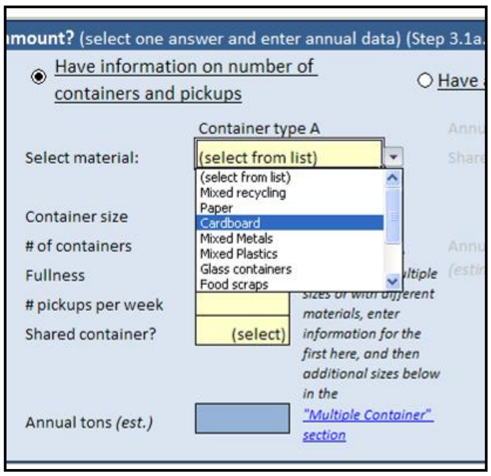
Similar to the Current_Trash sheet, the Current_Recycling sheet instructs the user to revise information about their current recycling amount, cost, or makeup. In Step 2.1a, the calculator asks what the user knows about recycling amount. The user selects one of three answers, which calculate the recycling amount in different ways. Depending on the user’s selection, the calculator will highlight the cells that must be completed for the calculations to work. Figure 7-17 shows the default option; the user does not have any information and the calculator estimates annual tons based on the average tons per employee per year for the selected sector, the number of employees, and whether the organization has a recycling program.

Figure 7-17. Step 3.1a Default



The next option, shown in Figure 7-18, is available when the user has some information about recycling service levels. The user selects the "Have information on number of containers and pickups" and enters the container size and units, number of containers, fullness, number of pickups per week, and, if the container is shared with other businesses, the percent from the user's organization. The calculator converts the volume from the containers into tons using the recycling density conversion factor shown on the Background_Data sheet. The calculator estimates this default recycling density conversion factor based on the composition of recycling; the user is able to revise the density factor if desired.

Figure 7-18. Step 3.1a Option #2



If the user has multiple containers, the service level entry option is expanded at the bottom of the page as shown in Figure 7-19. The user can enter up to six different containers in this section.

Figure 7-19. Step 3.1a Option #2 Continued (Multiple Bin Section)

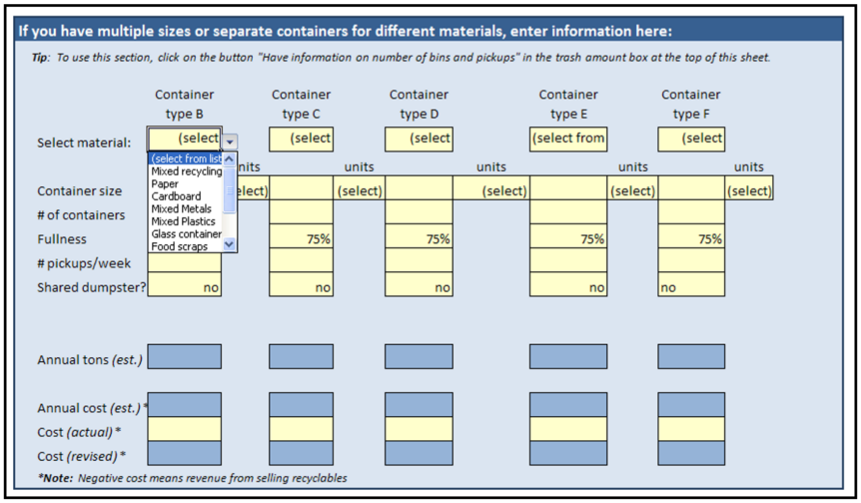
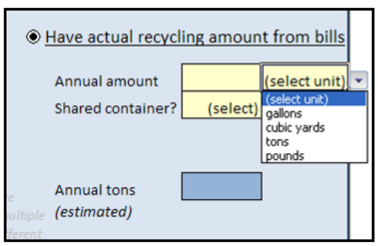


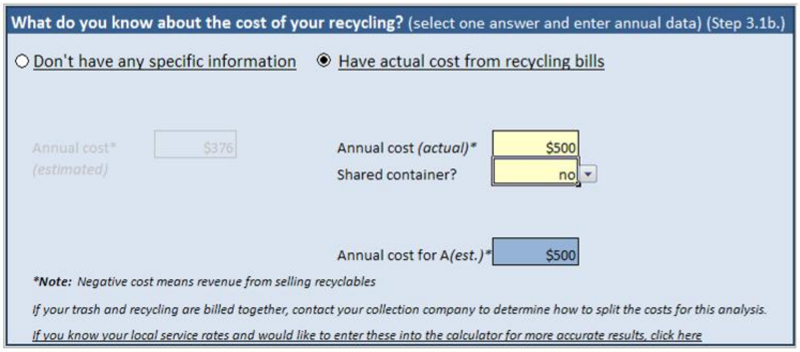
Figure 7-20 shows the most accurate option for calculating the amount of recycling, in which the user selects “Have actual information” and enters the actual amount of recycling from bills. The amount may be entered in gallons, cubic yards, tons, or pounds.

Figure 7-20. Step 3.1a Option #3



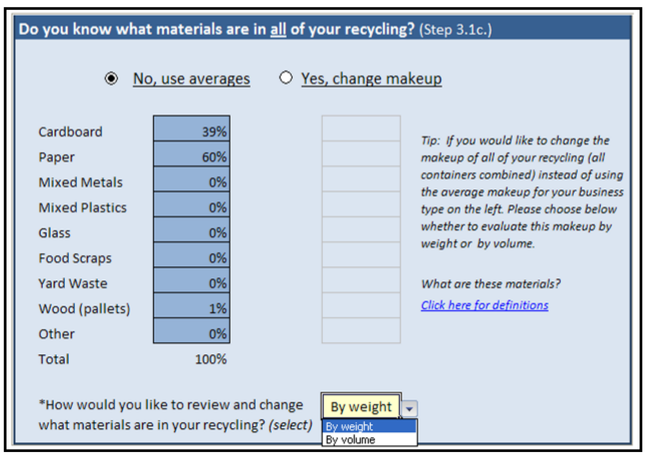
After choosing whether to revise information about the amount of the user’s recycling, the user has the option to improve the accuracy of the cost of the same recycling in Step 2.1b. Both options are shown below in Figure 7-21. The default option is available when the user does not have any information about the cost of recycling. In this option, the calculator applies regional cost per ton estimates, based on the user’s selected county, to the amount of recycling estimated in Step 2.1a. If the user has entered custom rate information (entered in the Custom_Rates sheet), the calculator applies these rates to the amount of trash from Step 2.1a. If the user has actual cost information, the user may click “Have actual cost from trash bills” and enter the information into the calculator. If the user has multiple containers of mixed recycling, the user may either enter the total cost of all containers into the cell in this section, or may enter the cost of each mixed recycling container into the cells in the multiple bin section discussed above. The user must enter the cost for each single material container into the specific cost column for that material.

Figure 7-21. Step 2.1b. Recycling Cost Section



Finally, after revising amount and cost information, the user may revise the recycling composition. Step 2.1c is shown in Figure 7-22.

Figure 7-22. Step 2.1c



The default option is for the calculator to provide the composition, which is calculated based on the sector and what, if any, materials the organization currently recycles. The calculator provides this default data by weight or by volume. If the user wishes to enter a new composition, the user selects “Yes, change makeup” and enters new percentages for each material type. If the user has selected to change composition by weight, then the user must enter the new makeup by percent by weight. Otherwise, the user enters the new makeup by percent by volume. Until the user has entered a new composition that totals 100 percent, the calculator will remind the user with an error message that the total does not yet equal 100 percent.

The calculator contains default industry average recycling data for all sectors except small hotels and manufacturing (these comprise 22 sectors in total). Users from these sectors can still use the calculator, but need to enter a few additional data elements. The user will need to enter actual composition by weight (not volume), cost, and service level or actual amount in the Current_Recycling sheet. If the user wishes to enter the amount of mixed recycling in volume (cubic yards, gallons) rather than weight (pounds, tons), they must also enter the density (pounds per cubic yard) of the organization’s mixed recycling in cell F71 of the Background_Data sheet.

At the bottom of the Current_ Recycling worksheet, the calculator lists error messages to alert the user if any information is missing that will result in calculator malfunctions.

After the user has reviewed the information and made any desired changes, they are directed to proceed directly to the Future_Benefits sheet.

4. FUTURE_BENEFITS

The Future_Benefits sheet summarizes the current waste and recovery results based on the data entered in the first three worksheets in the tool (shown in the green cells in the figure below). It also allows the user to evaluate the diversion, GHG, and financial benefits associated with future recycling and waste reduction efforts (data inputs shown in the red cells and results shown in the blue cells in the screenshot below). Figure 7-23 shows the table of results.

Figure 7-23. Evaluate Future Actions table

Evaluate Future Actions: Example Inc. — Click here for guidelines about actions

Recycling and reduction are different; click here for definitions

Click here for definitions of materials

	Current						Future Actions		Results		
	Annual Trash	Annual Recycling	Annual Total Material	Annual Recycling Rate	Total Cost Savings*	Carbon Footprint Reductions	Increase Recycling Rate to _%	Reduce _% of Total Material	Additional Trash Reduced	Additional Cost Savings*	Additional Footprint Reductions
Materials	Tons	Tons	Tons	%	$	MT CO_2e	%	%	Tons	$	MT CO_2e
Cardboard	3.0	3.8	6.7	56%	$755	12.9	75%		1.3	$259	4.44
Paper	3.1	1.3	4.5	30%	$278	6.2	50%	25%	1.5	$340	10.58
Mixed Metals	1.6	8.8	10.4	85%	$2,005	47.3	90%		0.6	$130	3.05
Mixed Plastics	0.2	0.0	0.2	0%	$0	0.0			0.0	$0	0.00
Glass	0.2	0.5	0.7	74%	$95	0.2	80%		0.0	$8	0.01
Food Scraps	0.8	0.0	0.8	0%	$0	0.0			0.0	$0	0.00
Yard Waste	0.2	0.0	0.2	0%	$0	0.0			0.0	$0	0.00
Wood (pallets, etc.)	9.4	8.3	17.7	47%	$1,811	16.0			0.0	$0	0.00
Other	17.7	0.0	17.7	0%					0.0	$0	0.00
Total	36.3	22.7	59.0	38%	$4,946	82.6			3.4	$738	18.1

Source reduction cost savings $100 *Enter the amount of money that you will save each year by not purchasing as much material.*

If you know your local service rates and would like to enter these into the calculator for more accurate cost saving results, click here

The organization's current annual tons of trash, annual tons of recovered materials, annual total tons of material (trash and recovered material), recovery rate, cost savings, and GHG reductions are shown by material in the green columns on the left side of the table. This section allows users to assess current programs and identify areas for improvement.

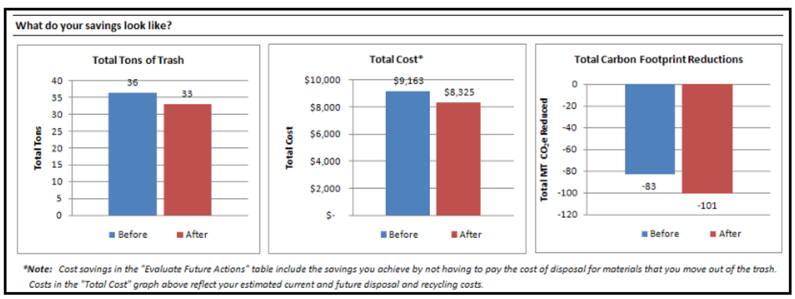
The user can enter new recycling or source reduction rates into the yellow cells in the "Future Actions" columns. The user must enter a percentage that is no greater than 100 percent. Although they may enter a new recovery rate that is lower than the current recovery rate, the calculator will present an error message to confirm the user wants to do so. If the current recovery rate is higher than the future rate, the results will be negative. As the user updates the future actions, the blue results cells will change based on the data inputs.

The calculator first applies the source reduction percentage to the total amount of material (trash and recovered materials). If the material being source reduced is currently being recovered, the calculator applies the source reduction to both trash and recoverable materials. After subtracting the source reduced material, the calculator applies the new recovery rate. The calculator adds the new recovered material to the material that is source reduced from the trash to calculate the future additional tons of trash reduced. The calculator applies the cost-per-ton estimates to these tons to calculate future additional cost savings. If a user has entered actual cost information or custom rates (entered in the Custom_Rates sheet), the calculator will use those revised costs per ton. Otherwise, the calculator will use the regional cost per ton defaults based on the county selected. The calculator estimates the additional footprint reductions by applying the source reduction, recycling, or composting emission factors to the tons of material that are source reduced, recycled, or composted.

This sheet also provides an option for the user to enter cost savings associated with source reduction activities, such as reduced purchasing costs. This amount is added to the total cost savings amounts in the graphs shown below the Future Actions table and in the Print_Report sheet.

As the user evaluates different actions, the graphs on this sheet are adjusted to give the user a visual representation of the benefits of different waste reduction and recovery levels. Figure 7-24 shows an example of the graphs, which include total tons of trash, total cost, and total GHG emissions reductions (i.e., carbon footprint reductions) for the current and future scenarios selected.

Figure 7-24. Future_Actions Graphs



The Future_Actions sheet also helps the user understand carbon footprint reductions in easier-to-understand terms, including the equivalent number of U.S. cars, U.S. homes' electricity use, and barrels of oil consumed, and number of trees it would take to sequester those GHGs. Figure 7-25 shows this carbon footprint translation section.

Figure 7-25. Carbon Footprint Equivalencies

What do my carbon footprint savings mean?

MT CO_2e stands for metric tons of carbon dioxide equivalent. This is the standard unit used to measure a carbon footprint. Tons of carbon dioxide, methane, and other greenhouse gases are all accounted for and converted to MT CO2e. These gases are emitted when you dispose and recycle.

It can be difficult to visualize what a MT CO2e really means. For this reason, **your additional and total** future emission reductions, including your current estimated emission reductions and any reductions from future actions, are shown below in easier-to-understand terms.

	Additional	Total	
Saving	**18**	**101**	**metric tons of CO_2e is roughly equal to:**
Annual tailpipe emissions from	3	19	U.S. cars.
Emissions from the electricity use of	2	12	U.S. homes over a year.
Emissions from	42	234	barrels of oil consumed.
The carbon dioxide captured by	464	2,582	tree seedlings grown over 10 years.

[1] The carbon footprint results in this calculator are not suitable for reporting your company's greenhouse gas inventory as required for major sources by the California Global Warming Solutions Act. Please visit the California Air Resources Board website for more details: http://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep.htm.

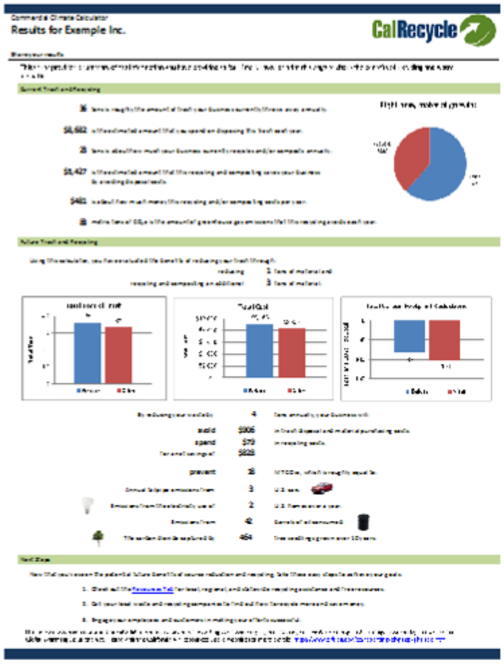
After evaluating the benefits of future actions, the user has completed the main sections of the calculator. However, they can always return to previous worksheets to update information.

The next few worksheets are intended to help the user take the next steps to implement future waste reduction and recovery actions.

5. PRINT_REPORT

The Print_Report is a one-page summary of current and future trash, recovery, and waste reduction activities. This single page, shown in Figure 7-26, can be downloaded to the user's desktop, emailed, or printed to share the results with employees, management, customers, or other stakeholders. It includes the current tons, cost, and GHG emissions associated with current and future activities, and the tons reduced, cost savings, and carbon footprint reductions from future actions. It also includes a few simple next steps the business can take to launch future actions today.

Figure 7-26. Print_Report



6. RESOURCES

The Resources sheet provides a list of resources to help the user get started in implementing their new actions. The Resources sheet instructs the user to contact their trash or recycling company and check their city's website. The page provides the name, website, phone number, and brief description of resources at the State, local and regional, and national levels, as well as material-specific and recycled-content purchasing resources. The inclusion of specific agencies or companies in this list should not be considered an endorsement of that agency or company.

7. GLOSSARY

The Glossary includes definitions of general terms, sectors, and material types used throughout the calculator. Links on the other sheets make it easy for the user to navigate quickly to the Glossary if the user is not familiar with a term. At the bottom of the Glossary page are links back to the other worksheets in the calculator. Similar to navigating in the other sheets, the user may either use these links to switch between pages or click on the sheets at the bottom of the workbook.

8. GUIDELINES

The Guidelines page provides guidelines and case studies for users to understand recovery and source reduction levels and potential at their organization. For example, by reviewing the experience of other businesses and multi-family complexes, the user may be able to gauge how much more they could recover. Ultimately, the Guidelines sheet is intended to assist users in filling out the future recovery and waste reduction levels in the Future_Actions sheet.

9. CUSTOM_RATES

The Custom_Rates page is intended for use by local government, recyclers, consultants, and other service providers who assist businesses and multi-family complexes in increasing recovery and waste reduction activities in a specific community. If the user has access to monthly collection rates, the user may enter them in this sheet in one of three rate tables: solid waste, recycling, and organics. An example of the solid waste rate table is shown in Figure 7-27.

Figure 7-27. Example Custom Rates Table

Solid Waste Collection Monthly Rate Sheet

☐ Check this box to use these custom solid waste collection rates

		Collection Frequency (Pickups per Week)						
Service Level		1	2	3	4	5	6	7
32	Gal	NA	NA	NA	NA	NA	NA	NA
64	Gal	NA	NA	NA	NA	NA	NA	NA
96	Gal	NA	NA	NA	NA	NA	NA	NA
1	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
1.5	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
2	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
3	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
4	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
5	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
6	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
7	Cu. Yards	NA	NA	NA	NA	NA	NA	NA
8	Cu. Yards	NA	NA	NA	NA	NA	NA	NA

Users can fill in cost information for 32-, 64-, and 96-gallon carts and one to eight cubic yard containers collected one to seven times per week. In order to use the rate tables, the user must check the box indicating that custom rates should override default cost values. Then, the user enters the cost of each relevant service level. If a service level is not provided, “NA” must be entered into the cell. The calculator assumes that blank cells mean that the service is free. If a user selects the box “Check this box to use these custom collection rates,” the calculator will automatically use the custom rates in that table for all cost-related calculations throughout the tool.

10. BACKGROUND DATA

The Background_Data sheet contains the key assumptions underlying all of the calculations. The General Conversion Data section contains basic volume conversions and material-specific density factors. It also shows the default conversion factors for mixed trash and recycling, which again are based on sector-specific composition of mixed and material-specific density factors. If a user wishes to revise these calculated density factors, new factors must be entered in the “User defined” column.

In the cost per ton section, the user can select a year for the default cost data from 2010-2020. This selection will draw the regional average cost data from the Cost_Data sheet. The combined cost is shown in the first part of this section, with the details of the calculations shown below.

This section also provides a map of the regions of the State to which the cost per ton data corresponds.

The GHG emission factors section shows the factors that are used in the calculations associated with emission reductions. The user can change any information on this sheet, if desired.

11. Waste_Data

This sheet contains the source data for default waste and recoverable materials quantities and composition for all of the 36 sectors included in the calculator. For more information about this data, please refer to the *Background Data* section of this report.

12. Cost_Data

This sheet contains the default average regional cost data. For more information about this data, please refer to the *Background Data* section of this report.

13. Calculations

The calculations sheet contains most of the background calculations. This page is left visible so that the calculator is transparent, however, the user should not make any changes to this page or the calculator will malfunction. The calculations on this page are described in more detail in Appendix Q.

Future Updates

As described in this report, the calculator incorporates the most accurate data available as of June 2010. The tool is designed to be updated as better data become available. Cal Recycle staff will be able to update waste, cost, and GHG emission factor data in the future to keep the calculator accurate and relevant.

Waste and Recycling Updates

The waste and recycling profiles for the selected industry groups may be updated, with the caveat that the industry groups and material types must remain the same. Data from future waste characterization studies may have to be manipulated to fit these groups and material types. New data can be incorporated into the calculator using the following steps:

1. Ensure that industry groups and materials match those in the calculator
2. Go to Waste_Data page
3. Click the Review menu and select Unprotect Sheet
4. Paste new profiles into Waste_Data page (cells C4:EO44)
5. Update source note to indicate source of new data
6. Select Protect Sheet
7. Save new version of calculator

The material specific density factors may be updated on the Background_Data page by entering a new density factor (in pounds per cubic yard) and source for a particular material type.

Cost Updates

The default waste cost profiles may be updated for future years if the regions and material types remain the same. To do this, Cal Recycle can take the following steps:

1. Go to Cost_Data page
2. Click the Review menu and select Unprotect Sheet
3. Enter new disposal costs; discount rates; collection, processing, and transportation costs and commodity revenues for the appropriate year, region, and material type (cells C29:DE69)
4. Select Protect Sheet
5. Go to Background_Data page
6. Click the Review menu and select Unprotect Sheet
7. Enter source for new cost data in cell E84
8. Select Protect Sheet
9. Save new version of calculator

Emission Factor Updates

New GHG emission factors can be entered in the Background_Data page. New emission factors must be in the units of metric tons of CO_2 equivalent per ton of material landfilled, source reduced, recycled, or composted. These factors can be entered into cells F193:I236.

Abbreviations and Acronyms

ARB – California Air Resources Board

C&D – Construction and Demolition Debris

CERF – Compost Emissions Reduction Factor

CNG – Compressed Natural Gas

COM-C&D – Commercially-generated waste from construction and demolition activities that is collected by commercial haulers

COM-MSW – Commercially-generated waste, not from construction or demolition activities, that is collected by commercial haulers

COM-SH – Commercially-generated waste, not from construction or demolition activities, that is self-hauled

COM-SH-C&D – Commercially-generated waste from construction and demolition activities that is self-hauled

CRRA – California Resource Recovery Agency

EPA – Environmental Protection Agency

GHG – Greenhouse Gas

HDPE – High Density Polyethylene

LDPE – Low Density Polyethylene

MRF – Material Recovery Facility

MSW – Municipal Solid Waste

MTCO2E – Metric Tons of Carbon Dioxide Equivalents (5MMTCO2E means 5 Million MTCO2E)

NAICS – North American Industry Classification System

PET – Polyethylene Terephthalate

RERF – Recycling Emissions Reduction Factor

SIC – Standard Industry Classification System

WARM – United States Environmental Protection Agency's Waste and Recycling Model

WRAP – Waste Reduction Awards Program

Glossary of Terms

Term	Definition
Alternative Daily Cover (ADC)	CIWMB-approved materials other than soil used as a temporary overlay on an exposed landfill face. Approved materials include processed green materials, sludge, ash and kiln residue, compost, construction and demolition debris, and special foams and fabrics.
Beneficial Reuse	Beneficial reuse of solid wastes at solid waste landfills includes, but is not limited to, final cover foundation layer, liner operations layer, leachate and landfill gas collection system, construction fill, road base, wet weather operations pads and access roads, and soil amendments for erosion control and landscaping.
Bin	A detachable Metal container, typically with a capacity of one to eight (1 to 8) cubic yards and hinged lid(s), which may have wheels, and that is serviced by a front-end loading collection truck.
Biomass Facility	A facility that utilizes the controlled combustion, when separated from other solid waste and used for producing electricity or heat, of (1) agricultural crop residues; (2) bark, lawn, yard, and garden clippings; (3) leaves, silviculture residue, tree and brush pruning; (4) wood, wood chips, and wood waste; or (5) non-recyclable pulp or non-recyclable paper.
Capital Cost	One-time setup cost of equipment, facilities, or land after which there will only be recurring Operating Costs.
Capture Rate	For a given material, the percentage captured through recycling methods relative to all material generated.
Cart	A wheeled plastic container with varying capacities of approximately twenty (20) to three hundred (300) gallons that is equipped with a hinged lid designed for mechanical collection by an automated or semi-automated collection vehicle.
Collection Cost	All of the Capital Costs, Labor Costs, Maintenance Costs, and Overhead Costs involved in the collection of materials from Generators.
Commercial	Any and all businesses, institutions, facilities, establishments, etc. including those businesses engaged in renting and/or managing multi-family properties.
Commercial Climate Calculator Tool (“Tool” or “Calculator”)	The tool created during the course of this project for use by individual businesses to make decisions regarding whether to reduce, recycle or dispose of materials and to evaluate the estimated costs and potential GHG reductions associated with those decisions. The tool is also intended for use by CIWMB staff, local jurisdictions, and others to help businesses explore Commercial Diversion options and provide technical assistance.
Commodity Revenue	Income derived from the sale of Recyclable Commodities
Compactor	A mechanical apparatus that compresses materials including two (2) to eight (8) cubic yard Bin compactors serviced by front-end loader Collection trucks and six (6) to fifty (50) cubic yard Drop Boxes serviced by roll-off Collection trucks.

Term	Definition
Compost Facility	Any plant, facility, or site used for the processing and composting of organic materials for the purpose of making compost, mulch, or other marketable material.
Compostable Paper	Includes paper or other fiber-based products that either by virtue of their design (e.g. paper towels, tissue, etc.) or by virtue of contamination with food are not suitable for recycling and are therefore better suited for composting. This does not include fiber-based products that are also composites of multiple material types.
Compostables	Includes compostable paper, food, and yard waste.
Construction and Demolition Debris (C&D)	Used or discarded construction materials removed from a property during the construction or renovation of a structure resulting from construction, remodeling, repair or demolitions operations on any pavement, house, Commercial building, or other structure.
Conversion Technology	Any one of a group of technologies including, but not limited to: anaerobic digestion, gasification, hydrolysis, mass-burn incineration, or pyrolysis, that converts materials from the waste stream into some form of energy which can then be sold to users of that energy.
Corrugated Cardboard (OCC)	OCC usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples include entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This type does not include chipboard.
Demand	Aggregate desire for a certain commodity within the Market supported by the aggregate capacity to purchase that commodity at the Market price.
Diversion	Generally defined as the reduction or elimination of the amount of solid waste from solid waste disposal. Diversion methods include Source Reduction, reuse, recycling, composting, and Beneficial Reuse.
Domestic Market	A Market that exists within the United States, for the purposes of this study, that purchases Recyclable Commodities and transforms them for the purposes of reuse or remanufacture.
Drop Box	A Drop Box, also known as a roll-off or debris box, means a wheeled or sledded container or compactor, generally with a capacity of six (6) to fifty (50) cubic yards, suitable for storage of solid waste, recyclable materials or compostable materials separately serviced by a truck that transports the Drop Box and the materials contained within to a landfill, MRF, Transfer Station, or Compost Facility.
End Use	The near-term final use of a Recyclable Commodity including, for example and not by way of limitation: creation of pulp from fibers; creation of pellets from Plastic; creation of compost from organic materials; and, creation of mulch from Lumber.
Equipment Cost	Capital Cost associated specifically with mobile or stationary equipment essential to the direct operations of the business.
Exclusive Franchise	The exclusive right granted to a Collector to conduct their business as defined and limited by a contract with a municipal agency, or other authorizing body, within a prescribed geographical area.

Term	Definition
Food (Waste)	Food material resulting from the processing, storage, preparation, cooking, handling, or consumption of food. Examples include discarded meat scraps, dairy products, egg shells, fruit or vegetable peels, and other food items.
Foreign Market	A Market that exists outside of the United States, for the purposes of this study, that purchases Recyclable Commodities and transforms them for the purposes of reuse or remanufacture.
Franchise System	A regulatory structure established by a municipal agency for the purposes of regulating the collection of waste materials within a geographical area where an Exclusive or Non-Exclusive Franchise is issued to one or more Collectors. The Legislature of the State of California, by enactment of the California Integrated Waste Management Act of 1989 (California Public Resources Code Section 40000 et seq.), has declared that it is in the public interest to authorize and require local agencies to make adequate provisions for solid waste collection within their jurisdiction. This legislation is generally understood to enable Franchise Systems.
Franchisee	The grantee of an Exclusive or Non-Exclusive Franchise issued by Franchisor.
Franchisor	The party, typically a municipal agency, granting a Franchisee the exclusive or non-exclusive right to operate within a specified geographic area.
Fuel	A substance that can be consumed to produce energy, including, but not limited to: diesel, gasoline, liquefied natural gas, compressed natural gas, ethanol, methanol, bio-diesel, and Fuel blends.
Fuel Cost	Costs associated with the purchase of Fuel used to collect, process, or transport Recyclable Commodities.
Generator	Any person or Commercial entity whose act or process produces solid waste, recyclable materials, or organic materials.
Glass	All recyclable Glass containers including whole or broken soda, beer, wine, and fruit juice bottles, peanut butter jars, and mayonnaise jars.
Greenhouse Gas Emissions	Gases that trap heat in the atmosphere are known as greenhouse gases. The principal greenhouse gases that enter the atmosphere because of human activities are: carbon dioxide, methane, nitrous oxide, and fluorinated gases.
Greenhouse Gas Emission Factor or Recycling Emissions Reduction Factor (RERF) or Compost Emissions Reduction Factor (CERF)	An emission factor is defined as the average emission rate of a given pollutant for a given source, relative to the intensity of a specific activity. Emission factors are used to derive estimates of Greenhouse Gas Emissions based on, for example, the amount of fuel combusted. Emission factors convert the greenhouse impact of a variety of gases into common units expressed in terms of metric tons of CO_2 equivalent ($MTCO_2E$).
Green Waste or Yard Waste	Includes various types of plant debris including leaves, grass, prunings, trimmings, branches, stumps, and other organic waste material resulting from landscaping or landscape maintenance activities.
Hauler	A person or party involved in the activity of collecting materials from Generators.

Term	Definition
Industrial	Of or pertaining to Generators whose activities generate waste streams in quantities or compositions that necessitate dedicated collection methodologies, for example, utilizing dedicated compactors, Drop Boxes, flat-bed trucks, balers, or other dedicated Generator-owned waste management equipment.
Labor Costs	Ongoing Operating Cost associated with the labor and personnel required to perform business operations including all regular, overtime, benefits, insurance, and incentive costs but not including costs for personnel performing sales, accounting, management, administrative, or other overhead functions.
Lumber	Processed wood suitable for recycling or composting, including but not limited to non-treated processed wood for building, manufacturing, landscaping, packaging, and non-treated processed wood from demolition. Examples include dimensional Lumber, Lumber cutoffs, engineered wood such as plywood and particleboard, wood scraps, pallets, wood fencing, wood shake roofing, and wood siding.
Maintenance Cost	Periodic cost incurred in activities that preserve an asset's operational status without extending its life. Maintenance is an expense that, unlike capital improvement (which extends an asset's life), is not capitalized.
Market	Final destination of Recyclable Commodities where they are purchased by the party who will transform them for their End Use.
Market Value	The dollar per unit value of a Recyclable Commodity paid when it reaches Market.
Materials Recovery Facility (MRF)	Any facility that processes a portion of the waste stream for primary preparation as a Recyclable Commodity or for End Use.
Metals	All recyclable Metal items including, but not limited to, tin/steel cans, major appliances, used oil filters, other ferrous, aluminum cans, and other non-ferrous.
Multi-Family	Any residential property which includes more than five dwelling units within a single complex or building.
Municipal Recycling Program	A recycling program administered by or through a local municipality as opposed to a program delivered directly by private sector service providers. In this program, rates are determined or capped by the local municipality.
Net Cost	Collection Cost and Processing Cost, including all Labor Cost, Equipment Cost, Maintenance Cost, Capital Cost, Transportation Cost, and Overhead Cost reduced by revenues from the sale of Recyclable Commodities.
Non-Exclusive Franchise	The non-exclusive, but limited, right granted to a Collector to conduct their business as defined and limited by a contract with a municipal agency, or other authorizing body, within a prescribed geographical area.
Open Market System	A regulatory structure that allows any number of participants to act in the economic free Market within a geographical area. These systems have no or low regulatory barriers to entry and may or may not require participants to secure permits for their activities from the regulatory agency or provide reporting to that agency.

Term	Definition
Operating Cost	All direct costs of operating a business including Labor Cost and Maintenance Cost, but not including Overhead Cost or Capital Cost.
Organic Materials	All biodegradable materials that break down in Commercial composting programs including, but not limited to, Food, leaves and grass, prunings and trimmings, branches and stumps, and agricultural crop residues.
Other Paper Grades	All recyclable paper except OCC including, but not limited to, paper bags/Kraft, newspaper, white ledger, colored ledger, computer paper, other office paper, magazines and catalogs, and phone books and directories.
Overhead Cost	All general costs of doing business that are not directly associated with the operations of the business including, but not necessarily limited to, Selling, General, and Administrative Costs, taxes, fines, donations, and Regulatory Fees.
Permit System	A form of Open Market System where participants in the Market are required to secure permits to operate from some regulatory agency separate from those that are required for environmental protection or business permitting. Permits occasionally require some minimal level of reporting on business activity and compliance with basic operating requirements.
Plastics	All recyclable Plastic container, film and products including but not limited to PETE bottles, other PETE containers, HDPE natural bottles, HDPE colored bottles, HDPE 5-gallon buckets – food, HDPE 5-gallon buckets – non-food, other HDPE containers, #3-#7 bottles, #3-#7 other containers, Plastic grocery and other merchandise bags, non-bag Commercial and Industrial packaging film, film products, other film, and durable Plastic items.
Primary Market	The highest and best use Market for a given Recyclable Commodity, which typically results in the greatest possible Commodity Revenue.
Private Sector Recycling Program	A recycling program administered directly by private companies or non-profit organizations as opposed to a program administered by or through a local municipality. In this program, rates are determined directly by private sector service providers.
Processor	A business engaging in the activity of processing portions of the waste stream into Recyclable Commodities in preparation for End Use.
Processing Cost	All of the Maintenance Costs, Labor Costs, Capital Costs, and Overhead Costs involved in the processing of portions of the waste stream into Recyclable Commodities for End Use.
Recover	The process of recovering Recyclable Commodities including Traditional Recyclable Materials, Organic Materials, and C&D from the waste stream and returning them to productive economic use.
Recyclable Commodities	Raw or processed material that can be recovered from a waste stream for reuse and have a value in the marketplace, even if it is a negative value, due, in whole or part, to their ability to be transformed into another state.

Term	Definition
Regulatory Fee	Any fee assessed upon business operations by a regulatory agency to recover the direct or indirect costs of either the deleterious impacts of that businesses activity or the regulatory agency's costs of regulating that business.
Residue or Residual	The material remaining to be disposed and which are not able to be recycled after materials have been sorted either by a Processor or for End Use. Examples include: Residual Plastics resulting from compost screening; Residual contaminated OCC or Other Paper Grades following Single-Stream MRF processing; and, residual fines resulting from sorting of Glass during color classification.
Rural Region	As defined by the U.S. Census Department, a Rural Area is all territory, population, and housing units located outside of an urbanized area or an urban cluster. For the purposes of this study a rural region is comprised of counties with individual disposal of less than 200,000 tons per year.
Self-Haul	Waste or recycling hauled by a Commercial establishment whose primary business is not hauling waste or recycling.
Selling, General, and Administrative Costs (SG&A)	A group of Overhead Costs including all costs associated with the management, accounting, sales, and administrative personnel and activities of a company.
SIC Code	The Standard Industrial Classification (abbreviated SIC) is a United States government system for classifying industries by a four-digit code. Established in 1937, it is being supplanted by the six-digit North American Industry Classification System, which was released in 1997.
Source Reduction	Reducing the amount of materials entering the disposed waste stream from a specific source by redesigning products or patterns of production or consumption (e.g., using returnable beverage containers).
Subsidy	Economic benefit or financial aid provided by a government to: (1) support a desirable activity; (2) keep prices low; (3) maintain the income of the producers of critical or strategic products or services; (4) maintain employment levels; or, (5) induce investment to reduce unemployment. The basic characteristic of all subsidies is to reduce the Market price of an item below its cost of production.
Supply	Aggregate amount of a commodity available for purchase at any specified price.
Target Material	Refers to materials targeted for recovery. For this study, Target Materials include Corrugated Cardboard, Other Paper Grades, Lumber, Plastics, Glass, Metals, and Organics.
Traditional Recyclable Materials	Refers to materials that are traditionally recycled in community-sponsored recycling programs. For the purposes of this study, those materials include Other Paper Grades, Cardboard, Metals, Plastics, and Glass.
Transfer Cost	All of the Maintenance, Labor, Capital, and Overhead Costs involved in the operation of a Transfer Station to transfer specified volumes of material.

Term	Definition
Transfer Station	A waste management facility that operates to accumulate waste materials and redirect, or transfer, those materials to landfills, MRFs, or End Use.
Transportation Cost	All of the Maintenance, Labor, Capital, and Overhead Costs involved in the transportation of materials from the Processor to End Use. These costs are distinct from Collection Cost, except where materials are moving directly from the Generator to Market or End Use.
Transporter	A business engaging in the activity of transporting portions of the waste stream to Market or End Use.
Urban Region	As defined by the U.S. Census Department, an Urban Area is all territory, population, and housing units located within an urbanized area or an urban cluster. For the purposes of this study an urban region is comprised of counties with individual disposal of more than 200,000 tons per year.
Vehicle Cost	A subset of Equipment Costs limited to the costs of purchasing vehicles for the performance of operational functions.
Waste Characterization Profile	The quantity and composition of waste generated by individuals, households, businesses, or communities. For this study, waste characterization data will relate only to California's Commercial sector, which includes businesses, municipal facilities, schools, and other institutions.
Wood (Waste)	Includes dimensional lumber, engineered wood, pallets, crates, and other wood-based materials and products which are not treated, painted, or otherwise rendered non-recoverable.